## Statistics of the Street Railroads of San Francisco.

Written for ENGINEERING NEWS.
BY GEO. W. SPECHT, C. E., SAN FRANCISCO.

San Francisco is the birthplace of cable roads. The introduction of this system marks the beginning of an epoch of large and extensive improvements of the city. Large areas, which were nothing but barren sandhills 10 years ago, are now covered densely with large business houses and thousands of fine residences. Last year was especially marked by an immense activity in building. The principal cause of this must be attributed to the extensions of the cable railways. Several months ago, the Board of Aldermen of New York City requested the Mayor of this city to answer a number of questions, referring to experiences gained here with the application of cable propulsion to street railroads. One question referred to the effect upon the value of real estate along the cable roads. The following table, compiled from official data in the Assessor's office, answers this question:

(Table showing benefit to and enhancement in values of real estate derived after construction of cable street railways traversing certain routes and districts in the City of San Francisco, as per official data and figures taken from the assessment-roll of real estate of the City and County of San Francisco, State of California; compiled by the Assessor's Department; signed by the Mayor.)

| Name of R. R. Co. | Date of commencement of construction. | Value of bordering lands the year previous to construction. | Value of the same lands in the year 1884. | Percentage of enhancement. |
|---|---|---|---|---|
| Clay street hill | 1873 | $ 775,740 | $ 1,089,365 | 40.42 |
| Sutter street | 1876 | 1,189,990 | 1,410,125 | 18.49 |
| California street | 1876 | 1,707,415 | 2,979,730 | 23.82 |
| Geary street | 1878 | 1,431,430 | 1,548,615 | 8.18 |
| Presidio and ferries | 1879 | 519,880 | 624,055 | 20.30 |
| Market street | 1879 | 23,309,495 | 26,801,200 | 14.98 |

The real estate taken into account embraces a distance of 200 feet on either side of the street. The period from which the assessment figures were taken was one of gradual recovery from the depression consequent upon the financial disaster of 1877. Another statement furnished to the authorities of New York reveals an opposite tendency in values along the lines of the horse-car railways. The year 1879 is the least unfavorable to the horse-car system of any that could have been chosen since 1878. Had the comparison been made between the date of construction and 1884, the difference would appear far greater. Property in the outlying neighborhood, being served only by horse-cars, can be sold with much more difficulty than that along cable-roads. The latter have developed and will continue to do so in a large area of the city, formerly unaccessible and undesirable for residence purposes.

(Table showing depreciation in value of real estate on and along certain routes and in certain districts traversed by horse-car street-railways in the City of San Francisco, as per official data, etc.)

| Company. | Value of bordering lands, 1879. | Value of bordering lands, 1884. | Percentage of depreciation in value. |
|---|---|---|---|
| Omnibus | $16,147,270 | $12,125,755 | 33.16 |
| N. Beach & Mission | 9,530,200 | 7,265,205 | 31.17 |

A few instances will illustrate the increase of value of real estate along cable-roads still better.

When the Geary street railroad was extended beyond Buchanan to Devisadero street, building lots along its line were sold for less than $70 a front foot. Now, in the same district, between California and Haight streets, the average price is $110 per foot, and in many instances the increase in value is greater than fifty per cent. The difference along the Haight street route is even more marked. Five years ago, an entire block, 412.5 ft. × 275 ft. on Fillmore street, was sold for $20,000. It is to-day, without improvements, worth at least $50,000. The approach to it is on a very steep incline, and horse-cars would not have added much to its value. Another block was sold, just before the construction of the Haight street cable-road, for $12,000. On the mere prospect, that the road was to be built, it was resold almost immediately to the railway company for $20,000. After the road was completed the company sold half of it for $30,000, and the other half is now held at $25,000. There are several cases like this. The mere expectation, that the Market street line will be extended along Castro street, which is now being graded, has already caused an advance in lots in that neighborhood. They could be bought a short time ago for $100 or less, but at a recent sale 46 lots brought $175 each; 23 lots in the same district were sold for $46,000; one-half of this block was resold immediately, at an advance of $300.

There are 12 street railroad companies in San Francisco. The Market Street Company possesses the most valuable franchises and does the greatest business. Until 1880 they used only horses; their main lines were opened as cable-roads August 1st, 1883. The company's cable roads are: the Market street line, Valencia street, Haight street and McAllister street. The first line is the main line and begins at the ferries; the McAllister street line branches off at the junction of the street of that name from Market street and the Haight street line at the intersection of the Haight street with Market street. The Valencia street may be considered a continuation of the Market street line.

The Haight and McAllister street lines terminate at the beginning of the Golden Gate park and connect there with the Ocean Beach R. R. (worked by steam locomotives), which ends at Ocean Beach. The Valencia street ends at 28th street.

From the corner of Valencia and Market st. an extension of the main line runs through Market to 17th and Castro streets, the cars being drawn by steam-motors. The company owns also three horse-car roads; the 5th street road runs through 5th and Bluxome streets to 4th street, where it connects with the Potrero and South San Francisco road; the Hayes valley line begins at Market street, runs along Hayes, Laguna and Fillmore streets to Ivy avenue.

The Market Street Railway Company has now 123 cars and 5 steam motors. The Valencia line uses 22 cars regularly and 13 extra ones during the busier hours. 18 cars run regularly on the Haight street line and 2 extra ones during busier hours; 15 are kept in reserve to be used on sundays and holidays, when the traffic is very heavy. The McAllister street line is equipped in the same manner. The Valencia street line is usually busier on week days than on Sundays, as it connects that part of the city where most people of smaller means (mechanics, retail merchants, laborers, etc.,) reside. The Ocean Beach R. R. has 16 cars, of which 4 are in constant use. The Market street extension uses only 2 cars and one steam-motor. 16 one-horse cars are running on the branch lines. The cable cars run every 3 or 5 minutes; the horse cars every 5 minutes, except early in the forenoon and late in the afternoon, when they run every 4 minutes.

J. L. Willcut, the Secretary of the Market Street Railway Company, makes the following statement in reference to the traffic of his company's lines.

| YEAR | NUMBER OF FARES. | REMARKS. |
|---|---|---|
| 1880 | 7,691,676 | April 24th, road extented from Market street to 17th street. |
| 1881 | 8,165,440 | |
| 1882 | 8,659,365 | |
| 1883 | 10,334,042 | August 1883, converted into a cable-road and new line put in operation on Haight street. Nov. 1883 additional line put in operation on McAllister street. |
| 1884 | 15,733,337 | |
| 1885 | 10,892,138 | 10 months. |

The Sutter Street Railroad Company owns a very advantageous system, which enables it to carry passengers, whose destinations are in widely separated portions of the city. The main line begins at the ferries, and runs up Market street to Sutter street. This part is used by horse cars; at the intersection of Sutter and Market streets the cable-road commences and runs along Sutter street to Central avenue. At the intersection of Sutter and Polk streets begins the branch cable-road, running through Polk to Post, through Post to Larkin, and along Larkin and Market to Ninth and Mission streets. Transfers are given at Polk and Sutter and at Mission and Ninth. The Polk street horse car railroad runs from Sutter along Polk, then along Pacific street to Fillmore; it uses the same cars, that come up on the Larkin street road. Transfers are given from and to the Union street cable line at Pacific street. This company has 48 cars, 18 of which are drawn exclusively by horses, and 29 dummies; 7 cars are kept in reserve.

For some unknown reasons the officers of the Sutter street road as well as those of the Union street road refuse to furnish accurate data about their traffic. But from observations made by uninterested parties, the following statement can be given as approximately correct:

| YEAR. | NO. OF FARES. | YEAR. | NO. OF FARES. |
|---|---|---|---|
| 1880 | 4,250,000 | 1883 | 5,500,000 |
| 1881 | 4,525,000 | 1884 | 5,550,000 |
| 1882 | 4,800,000 | | |

The Geary street cable-road is the next to the Sutter street line as to extent of traffic. It runs from the beginning of Geary street, at its intersection with Market and Kearney streets, and then runs along Geary street to Central avenue, where the passengers are transferred to cars drawn by steam motors, which terminate at the entrance to the Golden Gate park. On Sundays and holidays the traffic on this road is immense, provided the weather is fair. The park and the beach are the principal places of amusement of San Francisco. This company has 30 cable cars and 30 dummies and 10 cars drawn by steam dummies, of which they have 4. 24 cable cars and dummies are used daily. During the greater part of the day they run at 2-minute intervals, 2 extra cars being put on in the evening. The secretary of the company gives the following data in reference to traffic:

| YEAR. | NO. OF FARES. | YEAR. | NO. OF FARES. |
|---|---|---|---|
| 1880 | 2,911,395 | 1883 | 3,809,420 |
| 1881 | 3,422,406 | 1884 | 3,479,020 |
| 1882 | 3,600,729 | 1885 (to Sept. 1st.) | 2,375,285 |

The largest number of passengers was carried in August, 1883, while the Knight Templars' Conclave was held in San Francisco. The following table shows the aggregate of that and of other months remarkable for the volume of traffic:

| 1882 | NO. OF FARES. | 1883 | NO. OF FARES. |
|---|---|---|---|
| September | 321,000 | September | 326,360 |
| October | 346,000 | 1884 | |
| December | 329,500 | November | 323,230 |
| 1883 | | 1885 | |
| July | 326,258 | March | 323,045 |
| August | 423,044 | | |

The California street cable-road extends from Kearney street to Central avenue. It has some very steep grades. Since last May, $100,000 have been expended in improving the road. The company has 25 cars and 25 dummies, 20 being used continuously. The travel over this line has decreased considerably, as can be seen from the following data (in round numbers):

| YEAR. | NO. OF FARES. | YEAR. | NO. OF FARES. |
|---|---|---|---|
| 1880 | 2 993 0 0 | 1883 | 2 555,000 |
| 18-1 | 2 750,000 | 18-4 | 2.555,000 |
| 1882 | 2,600,000 | | |

The Clay Street Hill railroad is the oldest street railroad driven by an underground cable. Its traffic has been greatly affected by the building of parallel lines, especially since the Union street line is opened. Six cars and dummies are running every day, and 2 extras during the busiest hours of the day. (4 to-6 o'clock P. M.) It begins at Kearney street and runs along Clay street to Van Ness avenue. The following statement is an official summary of the traffic of this road.

| YEAR. | NO. OF FARES. | YEAR. | NO. OF FARES. |
|---|---|---|---|
| 1880 | 1.50 .000 | 1-83 | 1,226,000 |
| 1881 | 1,505 0 0 | 1884 | 1,217,000 |
| 1882 | 1,200,000 | | |

The Union street line is owned by the Presidio and Ferries Railroad Company. The cable-road begins at the intersection of Montgomery avenue and Montgomery street, then runs along Montgomery avenue to Union street, and then along this to Steiner street, where the passengers are transferred to cars drawn by steam motors; this line ends at the Presidio (U. S. Military Reservation). From the beginning of the cable-road to the ferries the line is worked by horses; 10 cable cars and 10 dummies are used regularly each day, 4 cars and 4 dummies being kept in reserve. The cars run every 6 minutes, and every 4 minutes during the busiest time of the day, on Sundays every 3 minutes. It is estimated that the Union street lines carry 3,250 passengers per day, or 1,200,000 a year.

The Telegraph Hill cable-road is built after a different system. A stationary engine hoists one car up and lowers another one. It was opened in July 1885 and is equipped with 2 cars, each carrying 93 passengers. In August 18 5, this line carried 21,000 passengers, 11.000 of them were transferred from other lines. This line serves mainly to transport people to a pleasure resort on the hill.

There are four other street railroad companies, who operate their lines with horses. They do a large business, although having suffered somewhat by the opening of the cable-roads.

The traffic over the different horse car lines during the last five years was as follows:

| YEAR | NO. OF FARES. | | | |
|---|---|---|---|---|
| | Omnibus line (4 single lines). | N. Beach & Mission lines (3 single lines). | City Railroad (2 single lines). | Central Railroad (2 single lines). |
| 1880-81 | 4,100,000 | 4,750,000 | 3 51 077 | 2,800,000 |
| 1881-8 | 3,70 ,0 9 | 5,0 0,000 | 3 3-6 78 | 3,000,0-0 |
| 18 2 83 | 3,400 00 | 5,500,0 0 | 3 :01 2 5 | 3,000,0 0 |
| 1883 84 | 3,700,000 | 5. 00,000 | 3,789,264 | 2,500,000 |
| 1884 8 | 4,000,000 | 5,500,000 | 3,3-2,100 | 2,100 000 |

The following table is a summary of the street railroad travel in San Francisco (in round numbers) during the year 1884:

| RAILROAD. | NO. OF FARES. |
|---|---|
| Market street | 15 70 ,000 |
| Sutter street | 5, 0 0,000 |
| Geary street | 3,4 0,000 |
| California street | 2, 0,000 |
| Clay street | 1,220,000 |
| Union street | 1 2 0 000 |
| Omnibus | 4,000 000 |
| N. Beach and Mission street | 5 5 0 000 |
| City | 3 30,0 0 |
| Central | 2 100 000 |
| Total | 44,630,000 |

The following table gives the total number of fares received by all the street railway companies last year and the total number in each of several successive years prior to 1880:

| YEAR. | NO. OF FARES. | YEAR. | NO. OF FARES. |
|---|---|---|---|
| 1 75 | 26 000 000 | 1878 | 27,600 0 0 |
| 1876 | 27,0 0 000 | 1879 | 30 000 0 0 |
| 1877 | 25,50 ,000 | 18. 0 | 41 630 000 |

The number of fares of this year will probably aggregate 48,000,000, or even 50,000,000.

**Municipal Engineering; Paper No. 1.***

## BOSTON, MASSACHUSETTS.

(*Continued from page 134.*)

A device in very successful use, but only lately adopted, for cleaning the sewers, is illustrated in Plate 20. The cut shows the dimensions and general arrangement for use in a 3 feet sewer; though the department has now under construction one intended to clear a sewer 5 feet high by 2 feet 3-inches wide, and contemplate using the same device in some 22-inch pipe sewers. The "kite" or scraper is in two parts for convenience in passing it down the man-hole: the bottom brace and its roller keep the rope in the axis of the tunnel at starting, but in practice the wheel shown under the ends of the rods was found necessary to counteract the tipping backward of the scraper by the weight of the long rope used; the smaller roller on top of this scraper was also found useful in passing any slight irregularities in the masonry. In practice it is put together, as shown in the figure, with 1,000 feet of rope attached, and passing over the fixed block in the frame over the man-hole with three or more turns; the scraper is then held stationary until the water behind it has risen to about the bottom of the man-hole, or near it, and the rope is then slowly payed out.

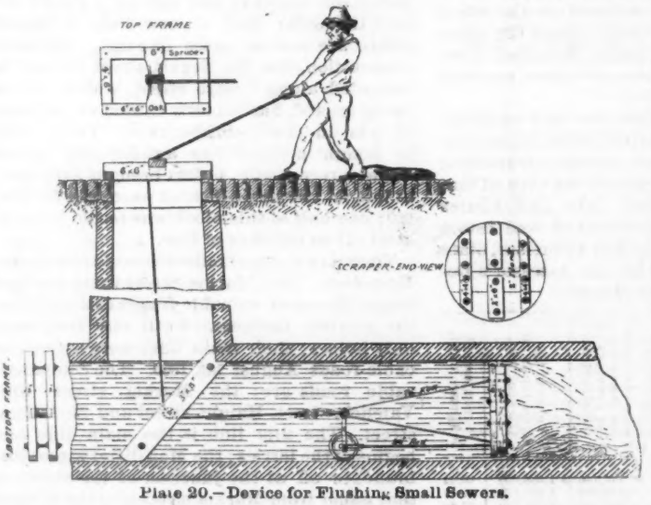


Plate 20.—Device for Flushing Small Sewers.

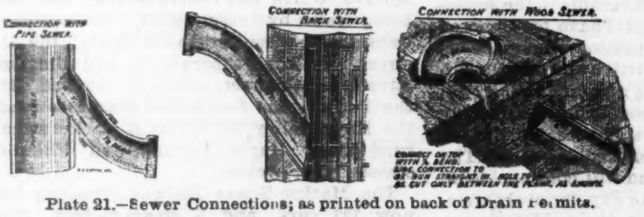


Plate 21.—Sewer Connections; as printed on back of Drain Permits.

The water thus dammed back escapes around and under the scraper, in the space there left, with a velocity sometimes equal to 16 feet per second, and cuts away and carries before it any accumulations in the sewer. We are informed by the Superintendent operating this cleaner, that in a sewer 4 feet high and 3 feet wide, he has forced ahead of his scraper a bed of sand and gravel averaging 8 inches deep and 100 feet long. When the debris becomes too heavy the scraper is stopped at a man-hole and the matter hoisted out. In answer to a query, the Superintendent says he has never yet been "stuck" between man-holes.

### Superintendent of Sewers.

*Appointment, Duties and Assistants.*—Though we have devoted considerable space to the Improved Sewerage of Boston as under the control of the City Engineer, there is still another distinct sewer department under the control of a Superintendent of Sewers.

This official is appointed annually by the Mayor, and he has charge of the construction and maintenance of all common sewers ordered to be made by the Board of Aldermen (other than the Improved Sewerage system), and has the care of all property pertaining to the sewers. He builds the catch-basins at such points and grades as the Superintendent of Streets may designate, and makes all necessary repairs to sewers for which appropriations have been made.

As before mentioned, the Board of Aldermen, in making assessments for defraying the expenses of building or repairing a common sewer deduct from such expense, a part not less than one-quarter, as they may deem expedient, which must be paid by the City; the remainder of such expense is assessed upon the persons and estates benefited, either by the entry of their particular drains or by any remote means; the assessment is apportioned according to the *area* of the lands benefited, without reference to the value of the improvements on the lands. An abatement is made for all land owned by the city and this is paid by the city.

The Superintendent of Sewers is allowed the following subordinates: one chief engineer, three assistant engineers, three clerks, three draughtsmen, and four foremen.

*Sewer Regulations.*—The Superintendent grants permits for all connection with common sewers, and in so doing prescribes the size, material, direction and mode of construction. The applicant for a "drain permit," who is usually the drain layer, is required to fill out a blank stating the point of desired connection, the owner of the estate and the size of drain contemplated, and he also agrees to make the connection with the sewer only in presence of a department inspector; or, if the work is repair only, not to cover it up until the inspector has seen it. On the back of each permit is a plan showing the various forms of connection allowed (Plate 21), and with it are rules prohibiting exhaust from steam engines entering private or public drains, or blow-off from steam boilers entering the same except through a catch-basin, and then only by special permission. No drain can be built of wood or be over 8 inches in diameter without permission; and no drain can be laid in the same trench with a water-pipe. These "drain permits" are only good for 7 days from date and must be given up to the police, who are required to ask for them, when they see an opening made for any such purpose. The drain layer must be licensed by the Superintendent of Sewers and give a bond with one or more sureties to indemnify the city for any damage arising from his acts; he must also be a competent mechanic and a tax payer

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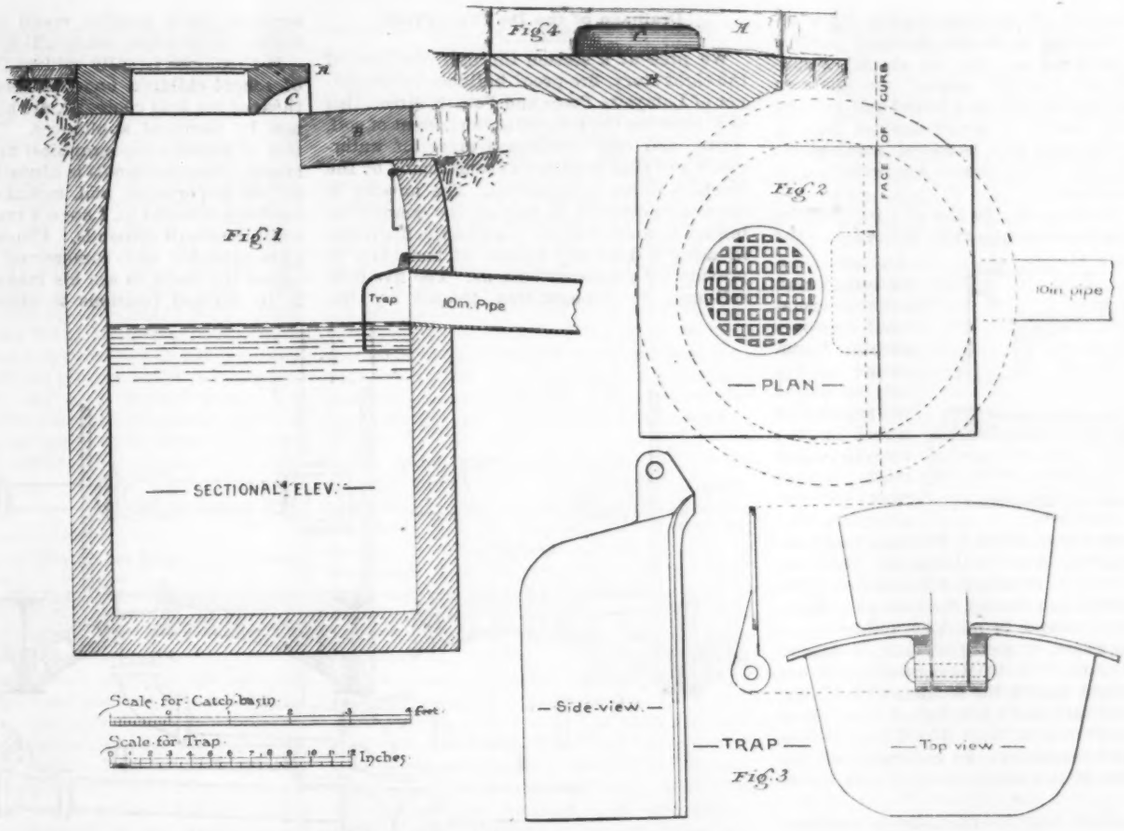



**Plate 22.—Standard Catch-Basin and Trap.**

of the city of Boston; no person who has broken the conditions of his license can be granted another for one year from the date of such breach. There is a penalty of not less than $20 for attempting to make a sewer connection without the written permission of the Superintendent of Sewers.

No owner can by the construction of a legal

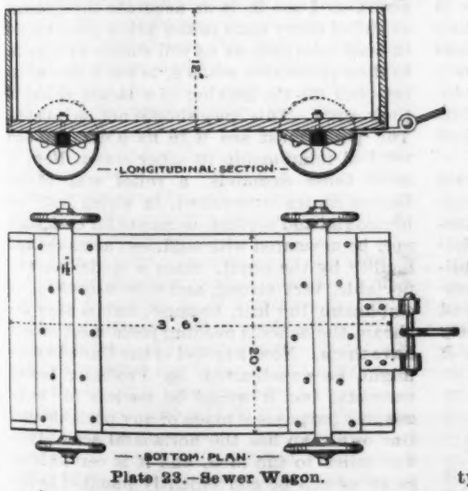



**Plate 23.—Sewer Wagon.**

private drain escape a lawful assessment for the construction of a common sewer in the same vicinity.

Clogged or broken drains must be repaired by the "owner, agent, occupant, or person in charge of the premises" within 5 days after receiving notice to that effect from the sewer department; if not so done, the Superintendent can repair or reconstruct at the expense of the parties above named, and these parties shall also be liable to a penalty of not more than $50.

A penalty of $20 for each offense is imposed upon any one permitting gravel, sand, ashes, or any substance liable to make a deposit, to enter in a common sewer. The Superintendent can compel any one to put a catch-basin in his drain to arrest such matter or to clean out existing basins; if not done within 10 days, the Superintendent can cause it to be done at the expense of the owner, etc., and also impose a penalty of not more than $20.

Every owner of real estate entering his particular drain into a common sewer from land upon which no sewer assessment has been levied, shall pay to the city therefor at the rate of two cents per square foot for all land benefited by such connection with 125 feet in of said sewer. The amount so paid is to be deducted from any subsequent assessment upon this land.

*Standard Form.*—Until very recently, there was no such thing as an adopted standard form for sewers in Boston; as already shown in Plate 16, almost of every possible variety types existed in that city, the most of them very objectionable in design, material and construction. In the later practice, the circular form predominates, though the "egg-shape" and slight modifications of the circle are also used for sewers under 5 feet in diameter.

*Catch-Basins.*—Plate 22 shows the prevailing type of catch-basin constructed by the department. They differ principally in dimensions and the location of the man-hole, which is sometimes on the street instead of in the sidewalk as shown. These basins are located by the Superintendent of Streets, and are usually about 250 feet apart. When the catch-basin is on a grade in the street, the entrance stone is shaped to turn the descending water into the basin, as shown in Fig. 4. The trap (Fig. 3) is open to some objections, as it requires the cement seal to be broken when it becomes necessary to empty the water from the basin, provided that it would be desirable to pass this water into the 10-inch drain-pipe. The usual practice, however, is to dam the gutter-entrance and hoist the water up the man-hole and pour it into the street.

*Sewer-Wagon.* Plate 23 shows a form of wagon used in cleaning out the sewers; its working is not eminently satisfactory, and another form with only one wheel in the front of the wagon is still more objectionable.

*Data.* The Superintendent of Sewers of Boston has under his charge 226 miles of sewers built by the city and under his control. The total number of catch-basins is about 6,000. The expenses of the sewer department, for the year ending June 30, 1885, were $328,894.50, for which were built 76,289 lineal feet of sewers and 251 catch-basins. The income of the department for the same period for assessments on sundry persons, drain permits, etc., was $29,793.29.

### City Surveyor.

*Appointment, Duties, Assistants.* The City Surveyor is appointed annually by the Mayor. He must be a citizen of Boston, and he, or his assistants, must make such surveys, plans, estimates and descriptions, and take such levels as may be required of him by the Mayor or the City Councils and furnish the City Solicitor with all necessary descriptions of lands.

He must also furnish plans and information to the Street Commissioners, or to any committee having charge of the laying out or widening of streets. He has custody of all surveys and plans relating to the laying-out, widening, extending or grading of streets in the city.

He is allowed 7 surveyors, 7 assistant surveyors or levelers, 1 clerk, 3 draughtsmen and 12 rodmen. He reports annually in January to the City Councils.

*Plans.* In his office all plans referred to by any action of the Street Commissioners or Councils are called "official plans" and of these there are now about 1,900; of plans of all kinds there are 18,000 on record. No standard scale or size of plan can be adopted, owing to

the character of the information often required; imperial or double elephant paper is usually adopted as size of sheet. Duplicates of all "official plans" are made on sheets of uniform size and bound and kept on file in the office to guard against loss in passing through the hands of committees, etc.; only the loose sheets are permitted to leave the office.

*Street Monuments.*—In the old part of the city all surveys are generally refered to fixed points on buildings and other permanent improvements. Monuments properly so called are principally used in the outlying districts, where they are usually made of a split granite post, about 4 feet long and 6-inches square at the top (Plate 24). Thev are dressed on the andabout 3-inches down the sides, and the top is sunk flush with the pavement. The center is marked either by a drill-hole alone, or a copper tack is leaded into this hole. On streets regularly laid out at about right angles, the monument is placed in the side-walk and 4 feet distant from either curb at street inter sections (Fig. 3); on crooked streets the monument is generally at the intersection of the curb stones, or just inside (Fig. 2).

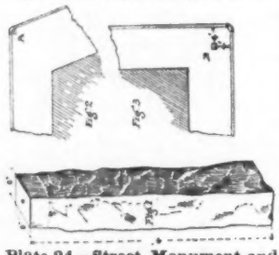


Plate 24.—Street Monument and Location.

*Standard of Length.*—The Boston standard of length is the U. S. standard brass-yard furnished to all the States. This yard was used to lay out a length of 100 feet on a heavy granite side-walk back of the City Hall, supported on brick arches, in which are contained the steam boilers. The divisions of this 100 ft. length are marked by drill-holes in which are copper bolts ¼-inch in diameter and marked by a ×; only the 0. 50-ft. and 100 ft. points are so indicated. This standard has been tested by the engineers of the U. S. Coast Survey in winter and in summer without finding any appreciable differences.

TO BE CONTINUED.

### The Age of Railroads in Different Countries.

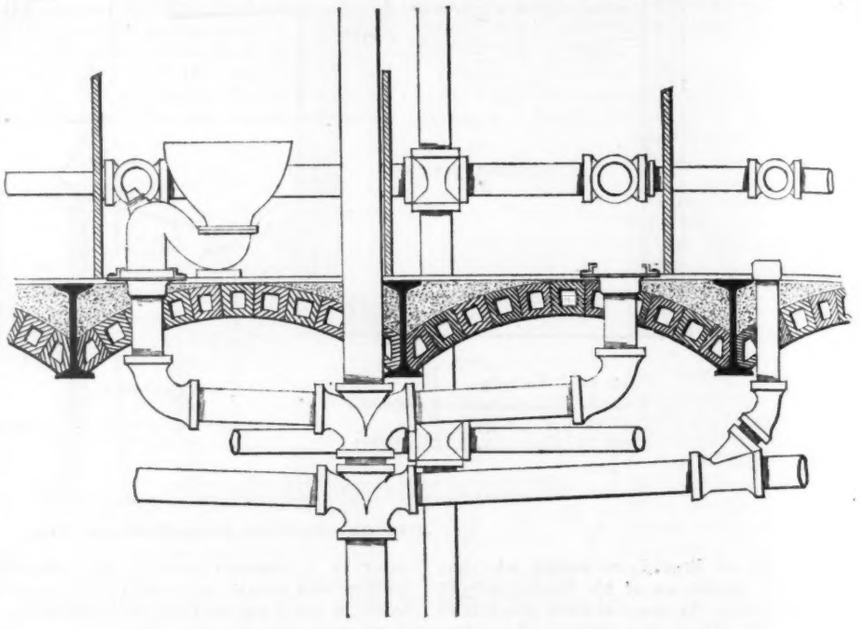
The *Statistique Suisse* gives the dates of the introduction of railroads in the following countries, from 1825 to 1860:

| | |
|---|---|
| England | September 27, 1825 |
| Austria | September 30, 1828 |
| France | October 1, 1828 |
| The United States | December 28, 1829 |
| Belgium | May 3, 1835 |
| Germany | December 7, 1835 |
| Island of Cuba | In the year 1837 |
| Russia | April 4, 1838 |
| Italy | September, 1839 |
| Switzerland | July 15, 1844 |
| Jamaica | November 21, 1845 |
| Spain | October 24, 1848 |
| Canada | May, 1850 |
| Mexico | In the year 1850 |
| Sweden, Peru | In the year 1851 |
| Chili | January, 1852 |
| East Indies | April 18, 1853 |
| Norway | July, 1853 |
| Portugal | In the year 1854 |
| Brazil | April 30, 1854 |
| Victoria | September 14, 1854 |
| Columbia | January 28, 1855 |
| New South Wales | September 25, 1855 |
| Egypt | January, 1856 |
| Middle Australia | April 21, 1856 |
| Natal | June 26, 1860 |
| Turkey | October 4, 1860 |

ENGINEERING NEWS, Three Months, One Dollar and Fifty Cents.

### Drainage of the De Vinne Press.

We present a section through one floor of the eight story, fire-proof building at the corner of Lafayette Place and Fourth street, this city, showing the general arrangement of soil, waste, and trap ventilation pipes for water-closet and sink drainage as constructed by the Durham House Drainage Co. The novelty in the design consists in placing the connecting branches under instead of above the floor, and in using a duplicate system of branches, to provide for future extensions. The five-inch soil-pipe, of wrought-iron, treated by the Bower-Barff process, is directly between the outlets of the water-closets, and eighteen inches from the wall back of it; it is one hundred feet high, supported by a brick pier in the cellar. The four-inch trap-ventilating pipe is close to the wall, and has connections under the floor for such fixtures as can only be reached by passing up through the floor instead of dropping down from the ceiling. This pipe branches from the soil-pipe just above its base, and is supported by it.



The building itself will repay examination by engineers. It is remarkable for solidity and thorough workmanship, and architecturally it is one of the most successful buildings in New York; its very appearance indicates that it is intended for a printing establishment. Roswell Smith, the proprietor, and Theo. L. De Vinne, the printer of the *Century Magazine*, are the owners; and Babb, Cook & Willard, the architects.

### Topographical Models or Relief-Maps.

In Nos. 153 and 154 of *Science*, reference is made to the use of exaggerated vertical scales in the construction of relief-maps or topographical models; and, as you have been good enough to refer to a piece of work in this line done by myself and wife,—but which is as yet private property in my study, and not upon the market, as might be inferred from your criticism,—I trust I may be allowed a word relating thereto.

There are various uses for topographical models, and that for which they are designed must necessarily govern their construction. While the technical geologist, in considering orographic questions, finds it undesirable to exaggerate the vertical scale of his cross-sections, such profiles would be absolutely useless in the actual construction of a railroad.

It should be equally evident that the needs of school-children under sixteen years, and those of the field geologist, are not necessarily met by identical appliances. The construction of suitable topographical models for use in the common schools is educationally of the utmost importance, and, now that the matter has been referred to, I hope it may receive the consideration it demands. Almost every great physiographic and commercial problem requires the pupil to see his locality and state in its vertical relations to other states and countries; and how best to enable him to do this, is not solved by Professor Lesley's dictum.

What we need to-day for educational purposes, as I see it, is as accurate topographic model of every state in the union, constructed in such proportions as will enable the pupils, in their respective schools, to use it as a working-plan for the making of a larger model of their state. This map should not be isolated. The pupil must see it in its horizontal and vertical relationship to other states. Now, to meet these demands, a relief map of the United States is required, in which both the horizontal and vertical elements for each state may be measured with sufficient accuracy and facility by the pupil. Such a model must be portable, very strong, and *extremely cheap*. I emphasize the last, because, unless they are cheap, the schools needing them most cannot have them. Now, a model of the United States might be constructed, as Professor Lesley suggests, but it would be useless for topographic purposes if made of any portable size. Our own map has the horizontal scale sixty-five miles to the inch, and it is certainly as large as can be conveniently handled in the average school room. But taking the Grand Canon district as an example of what might be done with both scales alike, using Mr. Duttons' profile, extending from the Markagunt plateau southward across the Grand Canon, for data, we should have the following profile:—

| | feet | sea level | | inch |
|---|---|---|---|---|
| 1. Markagunt plateau | 10,568 | above | or | .0295 |
| 2. North bank of Parunuweap | 4,659 | below | (1) or | .0130 |
| 3. Depth of bed of stream | 1,250 | " | (2) " | .0035 |
| 4. Height of Vermillion Cliffs | 1,818 | above | (2) " | .0063 |
| 5. Foot of Vermillion Cliffs | 1,363 | below | (4) " | .0040 |
| 6. Brink of Permian terrace | 1,022 | above | (5) " | .0030 |
| 7. Foot of cliff | 568 | below | (6) " | .0016 |
| 8. Brink of second terrace | 1,022 | above | (7) " | .0030 |
| 9. Foot of second terrace | 1,931 | below | (8) " | .0057 |
| 10. Brink of Grand Canon | 113 | above | (9) " | .0004 |
| 11. Bed of Colorado | 1,363 | below | (10) " | .0040 |

These figures are a sufficient proof of the impracticability of making a model of any large section of country without exaggerating the vertical scale, to say nothing of cheaply reproducing it with any degree of accuracy. Our map, constructed with the horizontal scale 5,000 feet to the inch, that is, the same as the vertical, would be about 16 rods long and 9 rods wide. Were it constructed with the vertical scale the same as the horizontal, Mount Whitney would be but .044 of an inch high; Mount Washington, .018 of an inch; and the highest point in Wisconsin, .0053 of an inch. Our model has attached to it one of the summits of the White Mountains, both scales alike, covering a rectangle 9 by 5 inches, and shows in itself just what the effect of exaggeration is. For my part, when I think of a mountain valley represented on the model, I think of it as 65 times wider than it is in the model; and I believe that pupils, if properly taught, will do so.

F. H. KING,
RIVER FALLS, WIS.

—*Science*.

## Examination of Water for Micro-Organisms.

DR. G. BISCHOF, IN THE "LANCET."

I. *Collection and transport of samples of water.*—1. A number of Erlenmeyer's flasks of 100 cubic centimetres capacity are plugged with cotton-wool and sterilized by heating in an air bath for one hour to 150-180 degrees C. They are used after cooling for the collection of samples of water. Pipettes, glass plates, etc., are similarly sterilized by being inclosed in sheet-metal boxes, with a tightly fitting lid of suitable dimensions, and heated in the air bath as above. 2. When filling a flask so prepared with a sample of water, the plug of cotton-wool is carefully taken out and held between the fingers of the left hand without touching the lower part of the stopper, or turning it upward. Some 30 cubic centimetres of the samples are filled in, and the cotton-wool is at once replaced. 3. The following precautions should be taken in filling the flasks: (*a*) From a tap or the like the water is made to run to waste for three or four minutes, and then directed into the flask, if possible, without touching its side. (*b*) From a reservoir, stream, etc., the water is collected by means of a sterilized pipette, and then filled into the flask as above. 4. The flasks should be so carried during transport as to prevent contact between the water and cotton-wool. 5. As far as possible all samples should be mixed with the nutritive gelatine, etc. (II., 2), within a few hours after their collection.

II. *Examination of a mixture of the water to be tested and nutritive gelatine, spread on a glass plate.*—1. Preparation of nutritive gelatine: One kilogramme of raw minced beef is mixed with two litres of distilled water in a flask, and left to stand for 24 hours surrounded by ice. The liquid is then squeezed by means of a suitable press into a flask, where it is mixed with 200 grams of ordinary white gelatine, 20 grams of peptone, and 10 grams of common salt. After standing for a short time, the ingredients are dissolved by gently heating the mixture, which is next neutralized by sodic carbonate. It should be rather alkaline than acid. The flask is plugged with cotton-wool, and the contents are heated in Dr. Koch's apparatus for sterilizing by steam* on two consecutive days for half an hour each day. The contents are now passed through a paper filter in a hot-water funnel, and about ten cubic centimetres of the light-yellowish filtrate filled into each of a number of sterilized test-tubes provided with cotton-wool plugs. These test-tubes must once more be sterilized by steam on each of three consecutive days for rather less than fifteen minutes. Nutritive gelatine thus prepared solidifies at the ordinary temperature, and is kept in the test-tubes ready for use. If the latter remain perfectly clear after a few days' standing, sterilization has been complete. This can be further confirmed by a blank experiment. 2. Application of the nutritive gelatine for testing water: (*a*) The contents of some of the above test-tubes are liquefied by immersion in water of about 30 degrees C. Mix the water in the sample flask by gentle agitation, remove the plug of cotton-wool as above (I., 2), and introduce as rapidly as possible into the test-tube by means of a sterilized pipette the quantity of water intended to be used for the experiment,† at once replacing the cotton-wool.

The water and gelatine must now be intimately mixed by bringing the test-tube repeatedly into an almost horizontal position, imparting to it at the same time a screwing motion. It does not matter if the mixture at this stage touches the cotton-wool. (*b*) A sheet-iron box is filled with glass plates which have been rinsed thoroughly and sterilized as above (I., 1). After cooling, the box is placed on its side and opened. A plate is taken out, reversed, and placed in a perfectly horizontal position on another glass plate which forms the cover of a glass dish. The latter has been *completely* filled with water and ice, and rests on a tripod, which can be levelled by means of screws. (*c*) The cotton-wool is removed from the test-tube, the open end of the latter passed once or twice through a Bunsen flame, and the liquid mixture poured on a glass plate in such manner as to form, after solidifying, as nearly as possible a rectangle, the surface of which can be readily measured, and is at least half an inch distant from the sides of the plate. Place a bell-shaped glass cover at once over the plate for a few minutes until solidification has taken place. (*d*) The plate is transferred to a moist chamber, consisting of a glass dish with a disc of moistened filter-paper at the bottom. A glass rest is placed on the paper to support the gelatine plate, and covered by an inverted glass dish slightly less in diameter than the other, and resting on the paper. (*e*) The sample thus prepared is kept for two or three days at a moderate temperature until the colonies have sufficiently developed. A basement-room answers well for the purpose on account of uniformity of temperature. It would probably be convenient to lay down the rule that the development of colonies be always determined after an incubation in the moist chamber of three days, only should there be danger in the case of very impure waters of the colonies growing into each other, their number must be determined on the second day, which then should be stated. The approximate temperature during incubation may be noted with advantage. (*f*) The number of colonies is conveniently calculated per cubic centimetre of water. It is determined by placing the plate after incubation on a dark ground. A glass plate, divided into square centimetres and one-ninth of a square centimetre, is so arranged on a hinge that it can readily be made to cover the gelatine plate without touching it. If there are many colonies their number is counted in some of the smaller squares, the average being calculated on the entire area of the gelatine.

With few colonies the larger squares should be made use of, or indeed the colonies counted all over the plate. A lens sliding on the top of the graduated glass plate assists in the discovery of the smaller colonies. Recently glass plates have been manufactured which are provided with a slightly projecting rectangle of enamel of uniform area. I have no experience with them; but if they stand the sterilization well, they would save the estimation of the total area, provided it be covered all over with gelatine. (*g*) Lastly, the number of liquefying colonies over the whole or part of the area of gelatine has to be counted as before. These colonies are probably due to micro-organisms which are in connection with putrifactive changes, and they are distinguished, after a little practice, by holding and moving the glass plate slightly inclined before the eye. It is of interest to note that, if the figures given by Dr. Frankland may be compared with those obtained in Dr. Koch's laboratory, the general purity of the water supply of the metropolis, as ascertained by recent analytical results, is fully borne out by the biological test. I hope to confirm this, as soon as some improved apparatus, now on its way from Berlin, has arrived.

III. *Remarks on the preceding method, translated from Dr. Becker's treatise.*—1. The germs contained in the water under examination are separated by mixing with the nutritive gelatine. When the latter solidifies they are deposited and fixed, each becoming the center of a colony. 2. Each distinct colony thus obtained is a pure culture, resulting from one single germ. 3. The number of developed colonies, therefore, bears a ratio to the germs contained in the sample. 4. Each sample of water differs quantitatively and qualitatively as to the bacterial germs it contains. Developed colonies show differences, visible even to the naked eye, in their color, their mode of development, liquefaction of the gelatine, formation of gases, etc. 5. The micro-organisms forming each colony may be examined more minutely by abstracting a minute portion (if necessary with the assistance of the microscope) by means of platinum wire, which has been previously heated to redness. Such matter is mixed with a drop of distilled water on a thin glass cover, and further treated as explained hereafter (V). 6. Certain forms of micro-organisms are invariably found in each sample of water, and with some practice a colony foreign to it may be detected without any great difficulty. 7. Water which is rich in products of decomposition is not suitable for drinking; similarly, water rich in the agents causing decomposition is unsuitable. It is not impossible that a sample of water may appear quite unfit for drinking, because it contains an unusually large number of micro-organisms, whilst chemical analysis fails to give warning. 8. The method appears peculiarly suited to the examination of the efficiency of filters, the germs in the water before and after filtration being compared.

IV. *Microscopic examination of a drop of the sample suspended on a thin glass cover.*—1. A small drop of the water to be tested is transferred from the Erlenmeyer flask by means of a sterilized pipette on to a thin clean glass cover. The latter is so mounted on the stage of the microscope* that the drop projects into

*The apparatus and materials referred to can be obtained from Dr. H. Rohrbeck (J. F. Luhme & Co.), 160, Friedrichstrasse, Berlin, N. W.

†The quantity of water to be taken for an experiment depends upon its quality. Generally two parallel samples are prepared, one cubic centimetre being added to the gelatine in one test-tube, and 0.5 cubic centimetre to that in another. The determination of duplicate samples is a desirable check, but in case there should be too many colonies in the sample containing one cubic centimetre of water to allow of their remaining distinct, the result of the other sample is accepted as more correct. I found such parallel results to agree as a rule very closely, even when more or less obtained by different operators. In the case of very impure water, as little as one drop may have to be taken to prevent the colonies growing together. Should this even be too much, the samples must be diluted with distilled water which has been sterilized by heating in steam, as above, for two hours.

*The microscopes in use in Dr. Koch's laboratory are provided with Abbe's condensing arrangement, two to three eye-pieces and two to three object-glasses, one of whhich is adapted to oil immersion, one-twelfth.

a cavity in the slide. The margin of the glass cover may be painted over with vaseline to secure it in its position. 2. After subsidence of the sample of water in a conical glass for twenty-four hours, a drop is taken from the bottom of the glass by means of a pipette, or, should there be suspended matter, a particle is collected by means of platinum wire which has previously been heated to redness. The drop or suspended matter is placed on a thin glass cover and examined microscopically as above. 3. The object of this examination is to determine the low forms of organisms not visible to the naked eye, their motion, color, etc.

V. *Microscopic examination of the solid residue obtained by evaporating a drop of the water under examination.*—1. A drop is allowed to evaporate on a thin glass cover under a bell-shaped cover. The thin glass cover is then taken hold of with a pair of pincers and passed about three times through the flame of a Bunsen burner. 2. A saturated alcoholic solution of methyl blue or fuchsine is prepared and diluted with distilled water until it becomes just transparent in a beaker three centimetres in diameter. The aqueous solution thus prepared is then poured over the thin glass cover, which is rinsed with distilled water after sufficient action of the dye has taken place. The glass cover is mounted with water, cedar oil, or Canada balsam. 3. A drop or particle of suspended matter is placed on a thin glass cover as in IV., 2, and next treated as in V., 1 and 2. 4. By the process of dyeing the outlines of the organisms present are rendered more distinct. Their shape and other properties have to be observed. If bacteria be present, their shape, similarity to morbific species, etc., should be noted.

### Dredging Apparatus for use in Shaft Sinking.

*Le Génie Civil*, of January 16, gives the following on dredging apparatus for use in sinking pier foundations, as exhibited at the Exhibition of Contractor's Plant in Paris:—

The vertical rotative dredge of M. Gabert, (Fig. 1.) is composed of a chain of buckets operated by a steam engine *M* and supported by the arm *E*, of which the upper part is vertical, while the lower section carrying the drum has a joint permitting an inclination towards the sides. This motion in the lower part is limited by the curved guide *F*, which keeps the arm at a proper distance from the sides of the shaft. The apparatus is supported while at work from a winch *A* by which it can be raised or lowered. A second and independent winch raises or lowers the upper drum of the chain of buckets to a degree corresponding with the inclination given the lower guide arm. The whole appliance is mounted upon a revolving platform so that all points of the inner circumference of the shaft can be commanded by the dredge buckets.

In using this dredge, the masonry walls are first built resting upon a timber base and lowered, until it has a bearing upon the river bed, by screws or other similar appliances. Dredging is commenced with the top of the masonry some distance above the water, surface, and when the top is near the water the whole apparatus is raised about 20 inches by three screws arranged for that purpose, and that much masonry added before sinking is commenced again.

This rotative dredge was successfully employed in sinking the basin for the graving-dock at Bayonne by the Administration of Bridges and Roads. The sinking was accomplished in a true vertical line, and the rate of decent in hard sand and tough mud was about 20 inches in a day of 8 hours work. The wells were 19.28 feet in exterior diameter, and 29.52 feet deep. In the last wells sunk a cutting

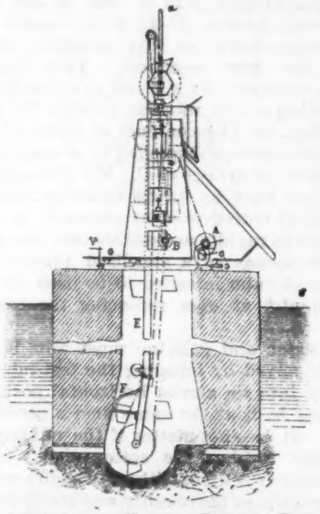


Fig. 1. The Gabert Vertical Rotative Dredge.

edge of beton was substituted for the timber foundation ring; there was a decided gain in speed of decent by the use of the beton.

M. Henri Satre, of Lyons, exhibited an apparatus (Fig. 2.), which answered somewhat the same purpose as the preceding. But as this machine was used to put in place blocks for the walls of a quay at Saigon, it was simply mounted upon a rolling carrier set perpendicular to the direction of the wall; the platform which carried the motor and the chain of buckets rolled upon the carrier parallel to the direction of the wall.

To vary the depth to which the bucket-chain is to work, this is disposed upon two

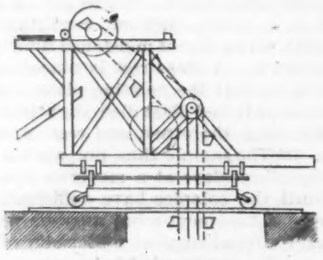


Fig. 2. The Satre System.

wheels of support, one forming the head of the chain, the other serving as a tender. The first is fixed in a certain position by means of a winch; the other rests upon a sliding support, which can be moved towards or away from the chain by an endless screw, operated by hand. And finally the chain is in two parts, in which one can enter into the other.

Fig. 3 shows a device used by M. Jandin in sinking tubular piers for the Palma del Rio bridge over the Guadalquivir river. The depth below the water surface to which these piers were sunk was about 34 feet. The sinking was at first attempted by using compressed air, but the frequent floods, slight depth to be sunk, and the counter-weight of about 70 tons required, caused the engineer to adopt the plan shown.

This apparatus is made up of a tube 8-inch diameter and connected at the bottom with another smaller tube carrying compressed air, which passes into the discharge column by an annular orifice not fully explained in its form. The theory of the device is that a mixture of air and water is formed in the discharge column which is lighter than the water outside, and the difference in pressure is sufficient to create a velocity of discharge

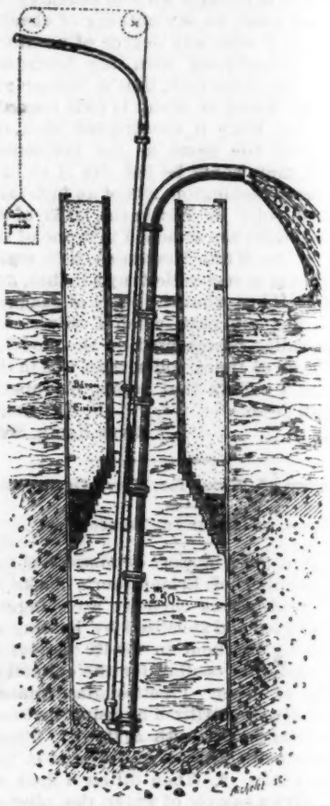


Fig. 3. The Jandin System for Pier-Sinking.

current that will carry with it a certain amount of the material to be excavated.

*Le Génie Civil*, of Jan. 23, in describing this device at Palma bridge, says that stones weighing 22 pounds were discharged through the tube, and that two men could shift the tube easily from place to place owing to the fact of the whole apparatus being counter-weighted as shown. The same dredge was used in sinking an open caisson for other parts of the same work.

The inventor claims that he can use it down to 40 to 50 metres, 131 to 164 feet, below the water surface in appropriate material, without exceeding an air pressure of 2½ atmospheres. The only conditions for its successful use are a depth of water of at least 10 feet and a height of discharge having for its practical limit one-third of the depth. He uses the same system successfully to transport material horizontally, the friction in the conduit being much decreased by the air mixed with the water.

### Macadamized Roads in Towns.

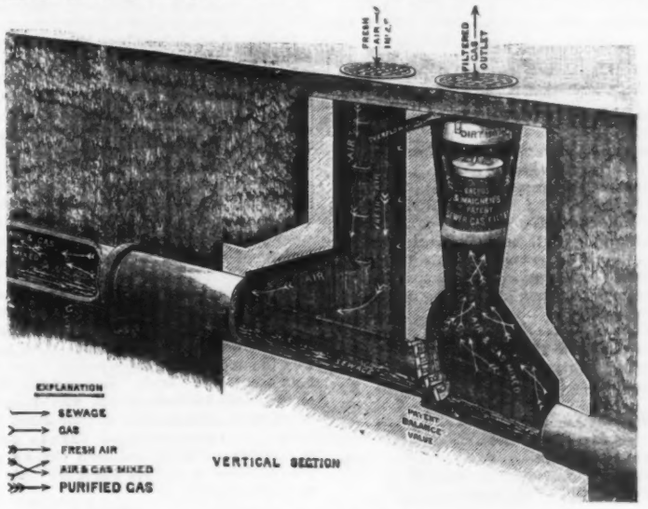
In the course of a letter on the maintenance of macadam roads, Mr. G. R. Strachan, the surveyor for Chelsea, writes:—

I have observed that a road made up with granite, which, after being rolled with heavy rollers, has a surface evenly and properly contoured and the junctions with granite pavements in foot crossings properly levelled, becomes "bumpy" after a few months' heavy traffic—that is, the even surface assumes an irregular shape, is full of depressions and corresponding ridges, which occur more frequently on the sides than in the center. The level junctions with granite pavements become depressed, and then the macadam rises in a wave-like form with a flat S-shaped curve. I have also frequently observed when a newly-made road is cut open that the buried stones have well-defined edges and angles, but that

when a bumpy road is cut open, the buried pieces have their edges ground off and their angles destroyed, as though they had been rolled along by some grinding action. I have also seen that the wheels of spring vehicles do not touch the surface at all times, but jump or bounce along, particularly when the vehicle is driven rapidly, and thus, instead of exerting an even wear on the road, they practically strike it a succession of blows as they run along. It has occurred to me that these three observations have a common explanation. The blows of the wheels tend to drive forward in the direction of their travel the pieces of granite, of which the road is made, and in doing so grind off their angles and edges, and the movement of these stones leaves a depression and raises a corresponding elevation. The irregularity of the holes in the surface is caused by the accident of a succession of blows on one part making a depression, which, when once made, rapidly grows. I have endeavored to watch the growth of these depressions and of the corresponding elevations, and I am inclined to the opinion that the depressions grow most rapidly in the direction of the traffic, and that the elevations move along the roads in the same direction. Thus, in a road of heavy traffic, where the rule of the road is observed, the length of a depression increases most rapidly in the direction of the travel, and, as a consequence, its growth on one side of the road is in one direction, and on the other side in an opposite direction. I do not state this as an observation I have completely verified, as the measurement of the depressions, owing to their undefined shape, is a matter of great difficulty; but I have observed the tendency in that direction. If it is a correct observation, it is explained by the effect of the blows of the wheels of the vehicles driving forward the stones forming the road. This movement of the stones explains the reason why country main roads wear into ruts, while town roads wear "bumpy." In the former the vehicles pass along the center of the road when travelling in both directions, only moving to the sides when passing each other. The blows tending to force the stones in one direction are counteracted by an equal number of blows forcing them in the other, and thus ruts or continuous depressions are made. In town roads the traffic, by observing sides, gives blows in its direction which are not counteracted, and thus the depressions are not continuous but irregular.

Another factor in this question is the sinkage of roads. On the Harrow Road at Kensal Town, I observed a few weeks ago that the average thickness of granite was not less than 16 inches. This is only to be accounted for on the supposition that the surface of the road has grown upwards, or that the foundation has grown downwards. The former supposition is not probable as the road is not above the surrounding land or above the doorsteps of adjacent houses. When it is borne in mind that the traffic weight per yard of width is over 300 tons per sixteen hours, it does not appear an unlikely hypothesis to suppose that the blows from the traffic and the weight of the same where the wheels press continually on the surface have beaten and pressed down the road. This road is not the only one on which I have observed signs of sinkage. The sinkage is facilitated by the fact that the sewers have practically drained the subsoil to the level of their inverts, and thus have given it the power of contraction to the extent of the volume of water removed.

If my explanations are correct, they give a theoretical proof of the fact, abundantly demonstrated in practice, that the limits are narrow within which macadam roads can be economically and carefully adopted in large towns where heavy traffic exists. In Chelsea it is found in the home district that where a macadam road costs 2s. 2d. per square yard per annum, it is an economy to take it up and pave it with wood. Sloane street, with a traffic weight of 270 tons per yard in width per ten hours, is economically paved with wood, so that the limit is well defined on the score of cost. If my explanations are correct, they point to an inherent defect in macadam roads, and show that with heavy traffic following the rule of the road they are altogether unsuitable. They do excellently as main country roads and streets of light traffic, but I trust I shall not be considered guilty of an unpardonable sin when I express the opinion that it will be a good day for London when all macadam roads in main thoroughfares are done away with, and paved roads substituted. The popular impression that macadam roads are the best roads that can be made, and that the defects in them, patent to all as they exist, are due to the stupidity of surveyors, is, I submit, a wrong one. Macadam roads in heavy traffic are noisy, dirty and expensive. The wear of the traffic is not the only cause of their deterioration, for the carbonic acid absorbed by the rain in falling acts chemically upon some granites, and reduces them to clayey mud.—*The Architect.*




Eachus' Sewer Ventilator.

## Eachus and Maignen's System of Treating Sewer Gas.

The engraving shows an arrangement for the ventilation of sewers invented by Messrs. Eachus, of 3, Great Queen street, Westminster, and Mr. P. Maignen. It has been practically tested at Edmonton, where it has proved the means of doing away with smells from ventilators on those portions of the sewers which are connected with some ancient drains in the district. As will be seen from the drawing, the system involves the division of manholes into two, or the construction of new double or divided manholes: and besides being applied to main sewers has been applied to house drainage in the case of the Town Hall at Edmonton. The middle wall shown on the plan may be replaced by a movable division constructed either in metal or wood, the lower part only of the wall being retained to receive the movable division. On this lower wall a valve is fixed, constructed in sections, each of which may be worked independently of those above, and the bottom section or sections may, if desired, be left out altogether so as to give an absolutely free passage for the normal flow of sewage. The effect of this division wall or lattice and valve is to stop the back flow of sewer gas, to divide the sewer into short lengths, thus preventing any accumulation of gas, and to give a free run to the sewage.

The varying flow of sewage, in wet and dry weather, and by day and night, secures a constantly fresh supply of fresh air, and the division of the sewer into lengths increases the circulation, causes any gas generated to be diluted to the greatest possible extent with atmospheric air, and keeps the temperature lower than under any other system.

Any kind of filter may be fixed in the gas outlets under this system, but the patentees have provided a form of filter which is very simple, and containes an ample supply of charcoal for a year's use, the charcoal being kept free from damp from above by means of an overflow, which discharges all surplus water from the dirt-box over the filter into the air inlet, where it runs away with the sewage. The damp from the sewer is condensed on the under side of the filter, which is in the form of a double cone of metal, perforated; and the charcoal taken out after several months' use has been found to be dry. One filter has been in use for twelve months. The lower edge of the filter is encircled by a ring of asbestos cloth to make an air-tight joint, and this part of the filter does not require perforation.

The upcast shaft, which is shown in the form of an inverted cone, may be made in any other shape, provided that a ledge is formed upon which the filter can rest, and where a movable division is used, it is by preference made square for convenience of construction.

The advantage of the system is that there is a free run for sewage from the water-closet in the house to the final outfall of the main sewer. The patentees prefer the use of trapless valve closets and the balance or flap valve shown in the drawing, without any syphon traps, so that there is one continuous free run for the sawage, and a free circulation of air through a series of down and upcast shafts along the lines of the main, branch, and house sewers.

The manholes are usually constructed in concrete, and provision is made for the prevention of any up draught in the downcast shaft; but twelve months' experience has, we are told, shown that such provision is not necessary, except under very abnormal conditions.

The system is about to be tried by Mr. W. G. Laws, C. E., in certain places at Newcastle, where the ventilation has given trouble. A medal was awarded to Mr. Eachus at the Inventions Exhibition for this invention.—*The Engineer.*

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WE will be obliged if subscribers who have not received the lithographed plates of the 1st and 2nd prize designs of Messrs. Hildenbrand and Schneider respectively for the Harlem river bridge, published February 20th and 27th in this journal, will notify us *at once*. By reason of an exceedingly stupid blunder of the lithographer in delivering the first plates at the wrong place, the Hildenbrand plate was not inserted in any of the copies sent out to New York and vicinity, and to the American News Co. In New York they were delivered by messenger immediately on discovery of the oversight, and they were included in the other papers of the following week. Application must be made without delay, if parties wish to secure the plate.

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A LEADER in a late number of the London *Financial News* under the title "Curiosities of Railway Fares," asserts that competition between railroads in England does not result in cheaper fares to passengers; instancing the traffic between London and Manchester, where, of four routes, the London & Northwestern, the Midland and the Great Northern have distances varying between 188 and 203.

These roads all run trains, starting from London at 5.15 A. M., 12. M. and 5 P. M., that make the distance in equal times, about 4 hours, and all through the day are slower competing trains, but there is no cutting of rates, and the "scalper" is unknown over there.

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A mechanical engineer has taken the trouble to bring to our notice certain specimen copies he has received of a so-called civil engineering paper, accompanied by a publisher's circular, from which we take the following:

We take pleasure in sending you the "——" for the months of February and March, without expense to yourself, as specimen copies. It is our hope and belief that within that time we shall become to you a "household necessity," filling as it were a long felt want, and that you will desire us to continue our semi-monthly visits. At the expiration of the time specified, should we hear nothing to the contrary, we will add your name to our list of subscribers on the principle that "silence gives consent."

Inquiry showed that several individuals connected with this office also received the same impudent proposition, the specimen copies sent bearing date December 31, 1885, and January 14, 1886.

Practices of this kind are a disgrace to journalism. Machinery establishments have large numbers of trade papers sent them, which they never ordered and never read. A circular such as the above, sent with the first copy, is very likely to be overlooked or never seen. Placing the names of the parties on the subscription list of such a publication, therefore, on the principle that "silence gives consent," and expecting payment for papers thus sent from busy men who either had no previous knowledge of the cool proposition, or did not take the trouble to order the paper stopped, is an act of effrontery, which should receive due attention.—*American Machinist.*

Several of our subscribers have sent us the circular referred to above, with comments thereon varying in degree of sarcasm, and with inquiry as to our opinion of that method of "working up a subscription list." We fully endorse the sentiments of our contemporary above quoted, and particularly so from our intimate knowledge of the migratory character of a subscription list of civil engineers and contractors. Among the weekly expenses of caring for a subscription list is a charge for "changing list," and these changes with us vary from twenty-five to seventy-five each and every week of the year, according to the season, and the activity of engineering work throughout the country. On the principle of "silence gives consent," the enterprising proprietors (who by the way are strictly anonymous) of the "household necessity" will undoubtedly soon pile up a list that ought to soften the heart of the most hardened non-advertiser. Who is not familiar with the methods of introducing these other "household necessities"—soap, soda and ink—by the briskly moving, glib-tongued agents, who storm one's kitchen or office, deposit samples of their wares "on trial" and depart, to return in a few days to get pay for the miserable stuff which has been thrown out, or otherwise disposed of, and for which the only alternative is the cash or a row.

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The law regulating newspaper subscriptions is such that it gives a sort of claim in favor of this "silence gives consent" principle, and the attempt to take advantage of the absence or carelessness of hoped-for subscribers should be promptly rebuked. It is not a straightforward, fair way of soliciting business, although it has been persistently pursued by certain western class journals, with what success is only known to their proprietors, but which certainly never added to their popularity or permanent gains.

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Emanating from the same city which is honored as the birthplace of the "household necessity" above referred to, is another anonymous scheme "with millions in it," styled "The Contractors' and Manufacturers' Intelligence Bureau," with offices also in New York and Chicago. The circular, dated "February 4, 1886," states that "Our plan is as follows, viz.: We are prepared to give information concerning the Letting of Contracts for Buildings, Foundations, Bridges, Sewers, Pavements, Railroads, City Improvements, Water Works, the Sale of Bonds, etc. Our correspondence covers the *entire United States*, and there is very little intelligence concerning lettings and contracts that will not be placed in our hands. We do not get this information for nothing, or in an accidental way, but by paying for it with CASH MONEY. No Agents. All business transacted at the Office."

With this is enclosed a blank contract giving terms as follows: "Notices 50 cents each. If contract is awarded to a subscriber, the additional charge is $5.00 for a $5,000 Contract, and $2.00 for a smaller one. No Contract taken for less than one year."

In this circular no clue is given to the location of the "office" either at headquarters, or in the other cities named. We made inquiries through a mercantile agency without success, nor could the agent of a subscriber who received a circular succeed in locating the "Bureau." A letter however brought an answer signed: "The Contractors' and Manufacturers' Int. Bureau.—H. G. WELTY, Manager.

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In the past eight years we have published more proposals for contracts than any other journal in the United States, and have gained a pretty thorough knowledge of the difficulty and expense attending such a department of news getting. We are glad to know that H. G. Welty has the CASH MONEY to pay "one agent" in "each place" on this broad continent. Whoever will take the trouble to examine a back file of ENGINEERING NEWS will find an advertisement of H. G. Welty, Bridge Builder. After a most persistent effort on our part to induce Welty to send us a check for amount due, *he instructed us to draw* on him for the immense amount of $29.25, total due; the draft was returned; we threatened, and in due time received $10 from a party whose name appears on the subscription bills of the "household necessity" above quoted, and no epistolary eloquence on our part has succeeded in securing the small balance due on the dishonored draft. And yet, if we mistake not, it is the same financial giant who has so much "CASH MONEY" invested in securing the advance knowledge of contracts to be let. We suppose that "the fools are not all dead yet," but if the contractors of our acquaintance are the men we always supposed them to be, they are not to be "Welty-d" by an anonymous circular, such as we have quoted. It will only be reasonable to ask for the "advance information" to be furnished in advance of payment; the contractors of the United States are not afraid of putting their addresses on their letter heads and they have no need to buy of an anonymous "Bureau" what they can always get one week sooner by reading ENGINEERING NEWS.

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## The Controversy between Chief Engineer Church and Construction Engineer Craven of the Aqueduct Commission.

The lack of harmony for some time previously existing between Chief Engineer B. F. Church and his subordinate, Engineer of Construction, Henry S. Craven, culminated last summer in a recommendation by the Chief Engineer that Mr. Craven be removed. The Aqueduct Commission, however, did not act upon this recommendation until at the last meeting about one week ago, when Commissioner Dowd was authorized to request Mr. Craven's resignation, with the further information that, if he did not resign, he would be removed forthwith.

As the outcome of this action of the Commission the following letter was forwarded to the Aqueduct Commission on March 2d:

*To the Honorable the Aqueduct Commissioners:*

GENTLEMEN:—Commissioner Dowd has informed me that, without any formal action on your part, you would be pleased to receive my resignation as construction engineer upon the new aqueduct. I infer from what Mr. Dowd says, and from the statements in the public press, that the demand for my resignation results, not from any acts of omission or commission on my part, but from a very natural wish on the part of the Commissioners to avoid being further troubled by a controversy, existing between myself on the one side, and Chief Engineer Church and, to some extent, some of the contractors, upon the other. That controversy is wholly of a public nature, having no personal element whatever, and its present situation is that in the discharge of my duties, I have felt called upon to make charges against Chief Engineer Church of acts involving serious betrayals of his trust. My own self-respect compelled me to make these charges. If I had not made them, I should, in remaining silent, have become an accomplice in the wrongs to which I have called your attention.

I am prepared to substantiate the charges which I have made. Indeed, you can find upon your own files evidence of the truth of many of them. Your Finance Committee still holds and refuses to approve bills approved by Chief Engineer Church containing charges against the Aqueduct Commission for articles furnished him for his personal and family use and for the pay of private servants put by him upon the aqueduct pay roll. You yourselves have seen the masonry at the Saw Mill River Crossing, which has been condemned by myself, two assistant engineers, and three inspectors, but accepted by Mr. Church. Nothing but incompetency or worse could accept that masonry as in accordance with the specifications of O'Brien & Clark's contract. I am ready to prove by engineers upon this work the truth of the report made by me that the contractors, O'Brien & Clark, have not withdrawn the timbering from over the roof of the tunnel or filled in the space with stone as required by the specifications, but have filled in the space with logs and timber in such a manner that, when they decay, the earth and rock above will have no support and will be liable to come down and crush the masonry. You can readily verify my report that, on the Fifth Division, at shafts Nos. 17 and 18, by an order of Chief Engineer Church, in violation of the specifications, timber already estimated and paid for once under the charge of excavation

being measured and paid for again as rubble masonry.

I will not resign, for by so doing I would admit that the charges which my duty has compelled me to make are not well founded. * * * This is the fourth attempt which has been made to prevent an honest supervision of the execution of the contractors' work upon this aqueduct. The first came in the form of an intimation from Mr. Maurice J. Flynn that I saw too much, was too exacting, had better be quiet and draw my pay, or that the Secretary of the Navy would be procured to terminate my leave and assign me to regular duty as an officer of the navy. These circumstances were promptly communicated to some of your number, and Messrs. Dowd and Spencer made an application to the Secretary of the Navy to forestall any action of the kind proposed. The second attempt was made in the form of an application to you by Chief Engineer Church for the abolition of the office of Construction Engineer, which I held under your appointment. You refused Mr. Church's application and declined to abolish the office. The third effort was by independent action on the part of Chief Engineer Church in withholding from me the contracts, reports, and other information necessary to enable me to discharge my duties, and this in direct violation of the rules adopted by you for the government of the chief and all other engineers upon the work. The effect of this action in violation of your rule is to make it impossible for you to know, and you do not know, what frauds may be in actual progress in the construction of the aqueduct. The division engineers' monthly estimates, upon which the contractors received their payments, were formerly examined and checked by the Construction Engineer, who in the course of his duties had actually seen the work progressing. About three months ago, I discovered and reported a considerable error made by Division Engineer Wolbrecht in favor of the contractors in the estimate for Division No. 3. The error arose from excessive measurement, giving the contractors over 50 per cent. more allowance for masonry than they were entitled to. Thereupon Chief Engineer Church ordered me to cease examining and approving the estimates unless for additions and extensions—a matter purely clerical, properly belonging to the Auditing Office in New York, and upon which my familiarity with the work as Construction Engineer would be of no value whatever.

The result is that, so far as practical benefit and efficiency goes, Chief Engineer Church has overruled the Commissioners and abolished the office of Construction Engineer. I say to you that under this action the door now stands open for frauds in the building of this aqueduct, of the extent of which you have no conception. * * * I cannot believe that the call for my resignation at this time is the sequel of the most recent and serious charges which I have made against Chief Engineer Church's conduct of the work, and which you have had in your possession for some time past, as official records.

Respectfully,
H. S. CRAVEN, Construction Engineer.

Chief Engineer Church in replying to a *Times* reporter regarding the charges made against him personally in Mr. Craven's letter, spoke as follows:

"It is all nonsense," he said. "In the first place I am not aware that any charges against me are or have been on file before the Commissioners. This is not a personal controversy between myself and Mr. Craven. It has simply grown out of the official insubordination of the Construction Engineer. As regards Mr. Craven's first accusation against me, I am not aware that the Aqueduct Commission or any of its committees holds and refuses to pay bills approved by me for articles furnished for my personal or family use. No such articles have ever been charged by me to the Commission, and there is no servant of mine on any of the aqueduct pay rolls. In relation to the masonry at Saw Mill Crossing, which Engineer Craven condemned, I will say that the wall there is one of the best constructed on the entire work.

"Now, to take up the accusation that I have permitted timber to be measured and paid for twice, once under the charge of excavation and again as rubble masonry. This charge is silly. In making an excavation the contractor is obliged to put in sufficient timber to sustain the masonry. He is expected to provide for that in his general estimates. If it is found necessary to leave the timbering in the tunnel, and masonry has to be built in around it, I consider it no more than fair that the timber shall be measured as so much masonry. In the two shafts alluded to by Mr. Craven the timbers were left in, because the rock roof of the tunnel was dangerous. It was thought advisable to let the timbers stay there in order to distribute the weight of the tunnel roof. There is no danger of the top masonry of the tunnel being crushed by the rotting of the timbers."

"How about the error made by Division Engineer Wolbrecht in favor of the contractors?" queried the reporter.

"That was a clerical error," said Engineer Church. "It was corrected before the estimates were sent in to the Commission. In order to prevent any recurrence of such errors, I instituted a check in my own office. The adoption of my method of checks of course relieved the Construction Engineer of that part of his duty. Mr. Craven says that I have withheld contracts and documents from him. That is untrue."

"What has caused this trouble between Engineer Craven and yourself?"

"Well, I don't know," replied Mr. Church. "I did what I could to secure Craven's appointment, partly on account of his uncle, with whom I worked as assistant for a great many years. As soon as he obtained the power that the office of Construction Engineer bestowed upon him, he began to presume upon it. The effect of his presumption became so serious that, in the interest of the work, I recommended the abolition of his office."

At the meeting of the Aqueduct Commission on March 3d, the above given letter of Mr. Craven was formally presented to the Commissioners after it had first been published in all the daily papers. Mr. Squire moved that the letter be ignored for the reasons just stated, as it should have been sent to the Commission before being furnished to the city press, but on motions of the Mayor and Mr. Loew it was finally read by Secretary McCulloh.

A resolution was then passed with but one dissenting vote. "That H. S. Craven be and he is hereby removed from the office of Engineer of Construction, to take effect March 4, 1886."

A second resolution also ordered that Mr. Craven's communication be submitted to a committee of three engineers, to be named by the Commission on next Saturday, who shall investigate the charges made therein by Mr. Craven. This resolution was unanimously adopted, and the matter thus settled.

## PERSONAL.

MR. W. H. H. GERE has been appointed City Engineer of Syracuse, N. Y.

JOSEPH BURTONE, a Philadelphia contractor, was found dead in his bed, at South Amboy, N. J. February 24th.

JESSE W. STARR, Sr., the founder of the well-known Camden Iron Works, died at his residence in Camden, N. J., on February 27th, aged 77 years.

W. F. HALSTEAD, General Superintendent of the Delaware, Lackawanna and Western R. R., has been elected to the position of General Manager of that company's line, both lease and proprietory. The position is a new one.

MR. EDWARD WESTERMANN, of Belleville, Ill., has resigned his position as civil engineer on the Illinois and St. Louis Railroad, and has been appointed to a similar position on the Mobile and Ohio Railroad.

CHARLES H. MYERS, late Principal Assistant Engineer with the Engineer-in-Charge of sewers of the City of New York, has been appointed Engineer of Construction in charge of streets and sewers in the Park Department of this city.

THOMAS BUSH, a member of the engineering corps of the Chesapeake & Nashville R. R., met with a serious accident, February 23rd. He was on duty fifteen miles north of Gallatin, Tenn., and while attempting to ride down an embankment, the horse fell upon him, inflicting serious if not fatal injuries.

HORACE LOOMIS, late Assistant Engineer Croton Aqueduct Department, has been appointed Chief Engineer of Sewers of New York, in place of Stevenson Towle, resigned. MR. LOOMIS is a graduate of the Troy Polytechnic Inst., and in 1875 was appointed an Engineer in the Croton Aqueduct Department. He is a member of the American Society of Civil Engineers, and is one of the Board of Civil Service Examiners for New York City.

EUGENE RICKBECKER, of the U. S. Geological Survey, sends us a handsomely executed topographical map of Mt. Shasta, California, lately surveyed by him. With it is also a photograph of this interesting extinct volcano; MR. R. tells us that sulphureous fumes are still given off from hot springs near the summit, and that the eastern half is covered with glaciers with solid ice from 80 to 100 feet thick. The original drawing was made from plane table sheets on a scale of 3 inches to a mile with 50 feet contours.

MR. FRED. WURTZ, a civil engineer in the employ of the Pottsville and Mahanoy Railroad, met with a serious accident at Gowen, Pa., recently. In company with Mr. Emile Low, chief of the engineer corps, he was walking over the railroad bridge when a train came upon them, and to save themselves from being run over, they were compelled to jump off the bridge to the ground below, a distance of fifteen feet. Mr. Low escaped without injury, but MR. WURTZ was badly injured internally. He was taken to the hotel at Rock Glen, where he was attended by Dr. Creasy, who pronounced his injuries very dangerous.

## Common Measures for America.

Senator Frye's bill for a congress of American nations, as published in the newspapers of Feb. 22, proposes to give to each independent nation of the western hemisphere a single vote in the decisions of the congress. One among many objects, for which the congress is proposed, is to consider the adoption of a common system of weights and measures; and this reminds us of several facts. The independent American governments number nineteen, thirteen of which have already adopted the metric system according to the report of J. K. Upton, as Chief Clerk of the Treasury Department, to the National House of Representatives, published in report No. 14, H. of R, 46th Congress, 1st session. Engineers from the U. S. A. testify to the use of the metric system on public works in Mexico, Colombia, Peru, Chile, the Argentine Republic and Brazil, and probably others. Of the remaining six governments, the United States, Hayti, Honduras and Salvador use the metric weight for coinage, leaving just two, namely, Nicaragua and Paraguay, out of the nineteen, uncommitted to the international measure at last accounts.

If the matter should ever be brought to a vote on Senator Frye's basis, our ancient local units must go.

## American Society of Civil Engineers.

At the meeting on Wednesday evening, S. Howard White, Director of the Society, in the chair, a paper by FRED BROOKS, M. Am. Soc. C. E., on *Thermometer Scales*, was read; also a paper by H. V. HINKLEY, M. Am. Soc. C. E., on *Errors in Railroad Levels*, was read by Acting Secretary E. B. Noyes. The following were elected:

FOR MEMBERS:—*Danforth Hurlburt Ainsworth*, (Geneva College, N. Y. 1850) formerly Chief Engineer Des Moines and St. Louis Railway; now engaged making surveys for Chicago, Milwaukee and St. Paul Railway Newton, Iowa; *Decatur Axtell*, formerly Assistant Engineer St. Louis, Iron Mountain and Southern Railway, and Superintendent of the Missouri Division; now General Manager and Receiver Richmond and Allegheny Railroad, Richmond, Va.; *William Herbert Burr* (Rens. Pol. 1872), (Elected Junior, June 3d, 1874; elected Associate May 5th, 1880), formerly Professor of Rational and Technical Mechanics in the Rensselaer Polytechnic Institute; now Assistant to the Chief Engineer of the Phœnix Bridge Co., Phœnixville, Penna; *Albert Lucius*, formerly Principal Assistant Engineer New York Elevated Railway, Constructing Engineer Brooklyn Elevated Railway, Principal Assistant Engineer of Bridges New York, West Shore and Buffalo Railway; now Chief Engineer Brooklyn, Bath and West End Railroad, Brooklyn, N. Y.; *Robert Edwin Peary*, (Eng. Dept. Bowdoin College, 1877), Civil Engineer U. S. N., Washington D. C.; *Charles De La Chervis Purdon*, formerly Engineer in Charge of Kansas River Bridge, Resident Engineer Texas and St. Louis Railway; Chief Engineer Little Rock and Fort

Smith and Little Rock, Mississippi River and Texas Railways; now in charge of Arkansas River Bridge, St. Louis and San Francisco Railway, Van Buren, Arkansas; *James Robert Wardlaw*, (School of Mines, Columbia College, 1876,) formerly Resident Engineer Jersey Shore, Pine Creek and Buffalo Railway; recently Inspecting Engineer, Beach Creek, Clearfield and Southwestern Railway; now Assistant Engineer Department of Public Works, New York City.

FOR ASSOCIATE:—*Clayton Colman Hall*, Actuary to the Insurance Department of the State of Maryland, Baltimore, Md.

FOR JUNIOR:—*George Washington Vaughan*, Supervisor Sub-Division 3, Pittsburgh, Cincinnati and St. Louis Railway, Steubenville, Ohio.

### The City Engineers of Boston.

As of historical interest in connection with the record of municipal engineering of Boston, now being published, we give a roll of the city engineers, etc., in charge of public works. This list is taken from the last report of the Boston Water Board; and as the water-supply of 1846 was doubtless the first public-work of any great importance demanding services of a strictly professional character, the list commences with the inauguration of its construction. The City of Boston doubtless had its chief surveyor before this period, but previous to the date given the work accomplished was hardly of a nature to warrant us in going beyond the following record:

*Engineers of Construction of Cochituate Water Works.*—John B. Jervis, Consulting Engineer, May 1846 to Nov. 1848. E. S. Chesbrough, Chief Engineer, Western Division, May 1846 to Jan. 4, 1850. William S. Whitwell, Chief Engineer, Eastern Division, May 1846 to Jan. 4, 1850.

*City Engineers in Charge of Works.*—E. S. Chesbrough, Engineer, November 18, 1850, to October 1, 1855. James Slade, October 1, 1855, to April 1, 1863. N. Henry Crafts, April 1, 1863, to November 25, 1872. Joseph P. Davis, November 25, 1872, to March 20, 1880. Henry M. Wightman, April 5, 1880, to April 3, 1885. William Jackson, April 21, 1885, to date.

The present official roll of engineers connected with the water works is as follows according to the report quoted above:

*City Engineer and Engineer of the Water Board*, William Jackson; *Superintendent Eastern Division Cochituate Department*, Ezekiel R. Jones; *Superintendent Western Division*, Desmond Fitzgerald; *Superintendent of Mystic Department*, J. Henry Brown; *Superintendent of Meter Division*, George S. Follansbee; *Superintendent of Inspection and Waste Divison*, D. B. Cashman.

### National Association of Water Works Contractors.

NEW YORK, March, 1, 1886.

At a meeting of water works contractors held at the United States Hotel in Boston on the 15th of January last, it was resolved that a Water Works Contractors' Association be organized for mutual benefit and protection; notices were sent to as many contractors as could be reached, and the first regular meeting was held at the Astor House, New York City, on February 17th.

At this meeting it was resolved to adopt the name of "The National Association of Water Works Contractors," and John T. Langford of 70 Kilby St. Boston, was elected President for one year; Wm. F. Inman, of 32 Liberty St., N. Y., Treasurer, and Chas. H. Eglee, of Flushing, N. Y., Secretary for same length me and a committee was formed to draw up by-laws and report at next meeting.

You are urgently requested to be present at this next meeting, which will be held at Metropolitan Hotel, New York City, on March 24th, next at 3 P. M.: and to notify every water works contractor of your acquaintance to be present also, as a large attendance is desired; other officers are to be elected and an executive committee formed, which should cover as large a territory as possible, and other business of vital interest to all water works builders will be transacted,

The meeting will be called at 3.30 and a collation served at 6 P. M.

In view of the great good which has resulted from combined effort in association in other branches of business, the benefit to contractors of such a society as this is at once apparent. No business needs protection as much as this particular branch of contracting, and it is hoped a large membership will be enrolled at this, the second meeting.

National Association of Water Works Contractors. *per* C. H. EGLEE, *Secretary*.

### Annual Meeting of the Ohio State Sanitary Association.

Reported for ENGINEERING NEWS.

The Ohio State Sanitary Association met in convention in Columbus, O., on February 24th and 25th. The forenoon of the first day developed little of interest, the attendance being very small, and all papers, except the one on "The Necessities of Physical Education," by Dr. A. H. Brundage, of Xenia, O., being passed by on account of the absence of the writers. Dr. Brundage's paper was a rhetorical flourish of trumpets on the general features of his subject, without laying down any methods or rules to be followed in bringing about practical results.

In the afternoon the attendance increased, and the Convention listened first to an address on "The Plague of Streets," by Judge Silas H. Wright, of Lancaster, an eccentric old gentleman, but evidently in dead earnest.

He claimed that towns and cities were contrary to nature; that sewers and house conveniences were death traps; that the river god will not submit to the pollution of his waters by running sewage into them and that he will strike back; that man is affected only by his own filth, that the excreta of every class of animals are poison only to that class, and are dangerous to no other; that more attention must be paid to the planting of trees and vines and shrubs, whose roots will do more to purify the earth than sewers; that self-maintaining sewers, such as hogs and geese and goats, must be encouraged, that outhouse vaults should be connected, the contents mixed with ashes and carted away every week, and the surface of the earth left so that poisonous exhalations cannot arise.

After some discussion, in which the power of trees and rivers to purify the air and hold in check miasma and malaria was given attention, a paper was read by Starling Loving, M. D., of Columbus, on "The Climate of Columbus." The topography of the city, the winds, the soil, the water, the heat, the cold, the fair and cloudy days, the rain, the snow, and the malarial diseases that are common, were descanted upon. The death rate was given as about twelve per thousand for the year ending March, 1885, which was not an exceptional case. The disagreeable features of the climate are due to its variance, not severity.

A volunteer paper was presented by William Halley, of the Columbus Plumbers' Association, on "The Plumber as a Sanitarian." Mr. Halley claims that the plumber is not given a fair chance. Plans are prepared for buildings by the architect, who thinks little of the plumbing, and at the last moment it is found that the plumber must be used, and the best arrangement of his work is prevented by plans drawn without any reference to the sanitary needs which he is expected to meet. The whole work is let by contract, the plumbing by sub-contract, and the plumber who has the least scruples gets the work, and then the effort is to see how close work can be done so as not to break over the letter of the specifications. Plumbers' work is not showy nor ornamental, and the expense is usually cut down accordingly.

"Municipal Sanitation" was the title of a paper read by C. L. Van Pelt, Health Officer of Toledo. The Board of Health in that city is entirely dependent on the City Council, and in almost every move they make they are handicapped and succeed in doing almost nothing. In strong contrast with this was the state of affairs in Cincinnati, where, a gentleman stated, the Health officers had almost unlimited power and succeeded in doing whatever they undertook. The necessity of a State Board of Health was urged to be appointed by the Governor and to be independent of politics, as a head of the local boards from whom they might derive their authority.

The evening session was held in the Senate Chamber. President Edward Orton, of the State University, occupied the chair and delivered his annual address, which was a very interesting paper. The establishment of local sanitary institutes was strongly urged as a method, by which the public could be more quickly educated up to the value and necessity of sanitary work, by the dissemination of sound doctrines on sanitary work. There never has been, to the present, so much discussion and study of disease germs, the spread of pestilence, as well as origin, and the preventives as there are now. Ill ventilation of school houses, blunders in heating, must be overcome. The people are at the mercy of the plumber, and he must be a sanitarian. The sewage question must receive more attention. The streams and lakes must not be polluted. The drill has shown that underneath the surface of the earth was an unlimited amount of salt water, but a very little of fresh water. Dependence can not be placed on wells and springs for water supply. Boards of Health have been established in thirty-one states, and Ohio should not be lower than the thirty-second.

Dr. J. H. Herrick, of Cleveland, Surgeon General of Ohio, then read a carefully prepared paper on "Food and its Relation to Disease." The only trouble with the paper was that it did not tell what foods should be used for different temperaments and diseases.

Thursday morning a paper on "Condensed Milk," accompanied with analyses and samples of several brands, was read by F. H. Darby, of Morrow.

"Who is Responsible for the Iniquities of the Third and Fourth Generations, and How can they be Avoided?" was the lengthy title of a paper by R. Harvey Reed, of Mansfield, Secretary of the Society.

"Sanitary Plumbing and House Drainage" was the title of a paper read by James Allison, of Cincinnati, President of the American Master Plumbers' Association. The principal features of the paper were, that no man should be allowed to practice plumbing unless his fitness for the business be determined by a competent board of sanitary plumbers appointed by law. There ought to be a well-constituted Board of Health with large power in each State, and one of the members should

be a sanitary plumber. Doctors and others may tell of the evils, but there is need of a sanitary plumber on the Board to tell the plumbers *how* and *what* to do to correct them. The doctor cannot do this.

"Defective Vision of Children; Causes and Management, with Reference to Pupils in our Common Schools," by D. R. Silar, of Sidney, was read next.

"Test for Impurities of Water Available for Physicians' Use" was the subject of a short lecture by Prof. C. E. Howard, of Columbus.

The last paper read was on "The Relations of Chemistry to Public Health," by E. R. Eggleston of Mt. Vernon.

Papers on the following subjects were either omitted entirely or read by title and ordered printed in the *Proceedings*. "Mistakes in School Architecture" by P. W. Search, Sidney; "The Climate of the Staked Plains, with peculiar reference to Midland Texas as a Health Resort," C. H. Lee Reed, Hamilton; "What our Country People should know about Drainage and Sewerage" by H. M. Fisher, Akron; "Introduction of Sanitary Science in Villages," F. G. Barnhill, Findlay; "Artificial Feeding of Infants," W. J. Conklyn, Dayton: "The Meat Question," E. T. Nelson, Delaware; "Domestic Hygiene," G. C. Ashmun, Cleveland; "Bovine and Humanized Virus and Supply of Virus," H. T. Sharp, London; "Cholera and its Prevention," D. N. Kinsman, Columbus.

The officers elected for the coming year are as follows:

President, H. T. Herrick, Cleveland, O. 1st. Vice President, E. T. Nelson, Delaware, O. 2d. Vice President W. H. Phillips, Kenton, O. 3d. Vice President, C. P. Laudon, Westerville, O. Secretary, R. Harvey Reed, Mansfield, O. Treasurer, John Simpson, Mansfield.

The place for the next annual meeting will be Columbus, O.

The attendance at the meeting was small, and was in the main composed of doctors, professors in medical colleges, plumbers and members of boards of health. Architects and civil engineers, who must necessarily have much to do with the health of the people, especially in cities, were "conspicuous by their absence." With two or three exceptions the papers were lacking in practical directions or suggestions as to how to bring about better public health. The need of it was told in general terms by almost all, each in his own line of argument, but what must be done, and how to do it, were answered by the demand for a State Board of Health. The proceedings with the papers, it is proposed to have printed in the April number of the "*Sanitarian*" at no expense to the Society.

## LITERATURE.

*Discussion of the Paper of E. L. Corthell, M. Am. Soc. C. E., on The South Pass Jetties*, by JAMES B. EADS, M. AM. SOC. C. E. 8VO., pp. 49, and 5 plates.

*Statement of Mr. Elmer L. Corthell before the Sub-committee of the Committee on Commerce of the House of Representatives in Reference to the Commercial and other Advantages of the Ship-Railway at the Isthmus of Tehuantepec in Mexico*, Feb. 5th, 1886. 8VO., pp. 23.

*The Certainties of the Nicaragua Canal Contrasted with the Uncertainty of the Eads Ship-Railway*, by DANIEL AMMEN. 8VO., pp. 33, and 1 plate.

These three pamphlets, which were given to the world on about the same day, should, for reasons that will appear on perusal, be read together.

Captain Eads' pamphlet is a reply to Col. W. E. Merrill's discussion of Mr. Corthell's paper on "The South Pass Jetties. Ten Years' Practical Teachings in River and Harbor Hydraulics," read at the Buffalo meeting of the Society, June 10th, 1884, and noticed subsequently in ENGINEERING NEWS.

Some collateral remarks in this paper on the work at Galveston, "drew" Col. Merrill into a discussion that led to two evenings discussion at the Society rooms, during April and May 1885, and a mass of manuscript that so far has overpowered the publishing facilities of the Society.

Captain Eads, apparently tiring of the delay in publishing, has printed his discussion with Col. Merrill's contribution and some unpublished reports by Gen. Newton, Chief, and Col. Mansfield, Engineer in Charge, as appendices.

The paper, which is written with some warmth of expression, sets forth Captain Eads' views as to jetties, gabionades and the relation between channel and velocity, illustrated by five plates, showing charts of Galveston harbor with profiles and cross-sections of the work already accomplished. Some of his statements bear directly on others contained in Admiral Ammen's pamphlet.

Mr. Corthell's "Statement" opens with a consideration of the sources and amount of traffic tributary to Isthmian canals, asserting that, while the annual value of the *over-sea* traffic of the world is $14 000,000,000, our railroad traffic is worth $12,000 000,000, and that by river and lakes amounts to half as much more. Then follows a discussion on the necessity for some means of transit, in which he sets forth the views held by this paper as to the probable solution of the Chinese troubles on the Pacific coast by the increased immigration that would result from cheaper fares and the advantage to railroads accruing from the increased transportation of products which are too bulky to pay railroad freights.

Speaking of the Nicaragua canal, he calls attention to the proposed cross-section, 3,492 square feet against the present cross section of about 3 700 square feet for the Suez and a proposed section of 8,575; but in general the "Statement" will be of more interest to statisticians than to engineers.

Admiral Ammen on the contrary manages to excite more or less interest from the commencement, where he says: "In a series of lectures and afterwards in a pamphlet, Civil Engineer Corthell, of New York, has given his views and assertions, which he styles 'The Scientific Solution of the Interoceanic Problem.' The fitness of the title is not apparent unless the use of the STEREOPTICON" etc., to the rather bitter ending: "The sad thing about it is that 12,000 women and many other persons of small means have invested their earnings in the Panama canal through the false representations of the Seligmans as to the official importance of the 'American Minister of Marine' becoming the American Vice-President of the company and thus establishing in their minds the sympathy and *quasi* support of our Goverment."

The Admiral on the second page intimates, if he does not charge that the proposed ship railway is not to be built in good faith, in the following words: "He *would be safe in his interest without a single vessel offering* and could convert his road into one for ordinary traffic with great advantage to himself and associates and without any advantage to our Government, as I shall show hereafter." The italics are by the Admiral, who proceeds further to give a rather "small beer" review of Captain Eads' professional experience, accompanied with diagrams showing the shoaling in front of the Mississippi jetties.

One of the Admiral's items will be of great interest to the profession, viz.: "Those who have studied the question do not agree with Major McFarland as to the necessity or any advantage of having a large harbor either at Greytown or Brito, for which of course the cost would be considerable and UNNECESSARY." The rather difficult problem of a harbor at Greytown has probably never received a more brilliant or original solution.

The remarks on the Panama canal present a successful condensation of M. Rodrigues' book on that subject into about 1¼ pages—which is accompanied by a profile.

About seven pages are occupied by a communication from Mr. Menocal (who we hope will not have the Admiral for consulting engineer on harbors), setting forth the comparative advantages of the Nicaragua route and combatting vigorously Mr. Corthell's views as to the future of canal navigation and its cost.

As a frontispiece there is a profile of the Nicaragua ship canal and to the same scale one of Tehuantepec "from Barnard's survey." As that survey was made, 35 years ago, for a railroad and not for a canal, the ability and high sense of honor displayed by General Barnard, might, considering that he has been dead for several years, entitle him to such respectful consideration, as is shown by giving his full name or his generally recognized title.

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THE introduction of natural gas at Pittsburg has reduced the quantity of coal consumed in that city 250,000 bushels per day.

THE village of Madoc, County of Hastings, Ontario Canada, with a population of 1500, a grist mill and a foundry, porposes to bring a public water supply from a lake two and a half miles distant. C. Fraser Aylsworth, C. E. and P. L. S., is the engineer.

# CORRESPONDENCE.

## Thickness of Abutments.

EDITOR ENGINEERING NEWS:

Do you or any of your numerous readers know of any American work that treats on the relative thickness of abutments and arches under varying heights of embankments? I know, Dr. Herman Scheffler (?) in a German work treats on the subject, but I would like to learn if there is any other. Under the ordinary practice of to-day little attention, if any, is paid to the height of the embankment over the arch, other considerations generally fixing the dimensions.

ST. O. NEARCH.

[We do not. ED. ENG. NEWS.]

## Problems in Curves.

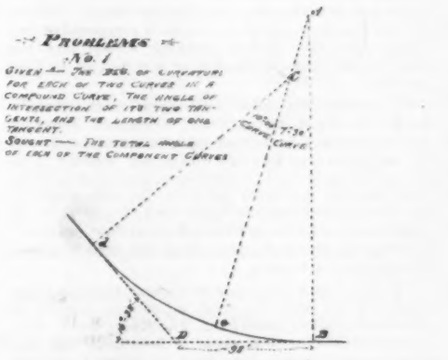
LYNXVILLE, CRAWFORD CO., WIS., Feb. 18th, 1886.

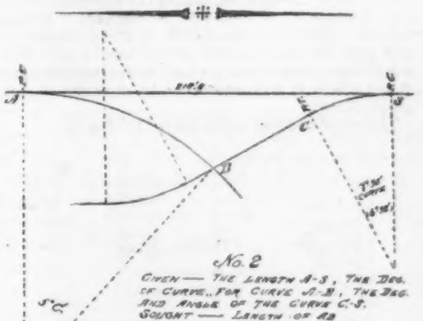
EDITORS ENGINEERING NEWS:

Find enclosed two problems which occurred in actual practice and which might be of interest to some of your readers. If you desire to publish them, I wish to have the answers addressed to me here, so, if you can consistently *state this*, in connection with them I will be obliged.

Yours truly,
F. W. WILSON,
Corps of Engineers, C. B.& N. R. R.

[Please to address answers as requested.—ED. ENG. NEWS.]


PROBLEMS
No. 1
Given—The Deg. of Curvature for each of two Curves in a Compound Curve, the Angle of Intersection of its two Tangents, and the Length of one Tangent.
Sought — The Total Angle of each of the Component Curves
Compound Curve
Tangent
7°30'
C
D
B




## A Novel Grist Mill.

LEXINGTON, KY., March 1, 1886.

EDITOR ENGINEERING NEWS:

The description of an ancient saw mill in your issue of February 20 (page 126 ante) leads me to describe a modern grist mill of a type but little known, and which bids fair to become totally extinct, as the advance of civilization spreads improved milling appliances over those benighted regions which still remain unsupplied.

The mill in question was seen last autumn on the head of the Red Bird creek, Clay county. An intimate knowledge of the "railroad wilderness" of eastern Kentucky has developed the existence of no other specimen of the kind, hand-mills and home-made, four-bladed turbines having generally succeeded them.

This "pounding-mill" as it is called, consists of a mortar, a short section of a tree with a hole scooped out of one end of it, and a wooden pestle attached to

one end of a beam pivoted in the middle and with a trough 3 or 4 feet long, capable of holding about half a barrel of water, cut out of the other end. A stream of water is led to the trough by a conduit, made of the bark of trees 4 or 5 inches in diameter, a distance of perhaps 100 feet. The beam is so balanced that when the trough is full of water that end drops down, the water rushes out, on account of the resulting inclination of the beam and trough, which, being relieved of its load, is lifted again to its horizontal position by the weight of the pestle end, and is again filled with water.

The mortar is kept in a position suitable for the pestle to act in it, and it is said that a half-bushel of corn put in the mortar at night will be converted into very nice meal by the next morning; but it is added that sometimes the meal is not so good, owing to the intrusion of hungry field mice, or other small animals, which also are pounded up and inseparably mixed with it.

Perhaps it should be added in further explanation that the mill is set in the forest without covering or protection of any kind.

J. M. Hodge.

## Graphic Determination of Stresses on Rivets in Plate Girders.

Chicago, Feb. 25th, 1886.

Editor Engineering News:

In your issue of the 13th inst. you published an article entitled "Graphic Determination of Stresses on Rivets in Plate Girders," which is certainly a new departure from the old method of determining the stresses on rivets of flanges.

The author makes the following statement: "Therefore the resultant stress on rivets is composed of two components—the vertical shearing stress, and the flange stress, either horizontal or inclined, as the case may be."

The customary practice is to proportion the rivets in flanges to resist the greatest horizontal shearing strains at line of connection between angles and web; but as the shear at this line differs but slightly from the maximum shear at neutral axis, the latter is often used instead, the error being on the side of safety. The horizontal shear per lineal foot at any point of girder is equal to the vertical shear at that point divided by the depth of girder h (depth used in determining flange stresses).

If we now divide the horizontal shear per lineal foot by the bearing value of a rivet, we get the number of rivets required per lineal foot. The rivets being proportional to the vertical shear, it is evident that the maximum shear should be used in determining the number required.

The author, further on, makes the following erroneous statement, to elucidate his method: "Suppose now we remove the loads *C, D, E, F, G*, leaving only the loads *B* and *H* on the girder, then *A B* in Fig. 4 would be the maximum bending stress between points *B* and *H* (Fig. 1), and, consequently, at center of of the girder E., etc."

This error can best be illustrated by Fig. 2.

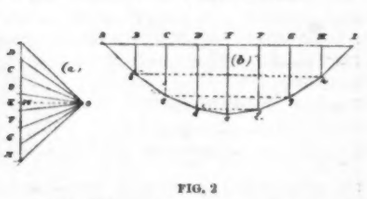


FIG. 2

By total load the length *A B* in Fig. 4 represents the flange stress at *B* and *H*, in Fig. 2. $A\,B = \frac{B\,b \times o\,M}{h}$

By removing the loads *C, D, E, F, G*, in Fig. 2, the flange stress for all points between *B* and *H* would become

$$\frac{B\,b^1 \times o\,M}{h}$$

the equilibrium polygon being represented by the dotted lines *A, b¹, h¹, I, A* and not by *A, b, h, I, A*, as assumed by the author. In like manner his statement regarding increase of bending stress between points *C* and *G*, Fig. 2, can be disproved.

Yours truly,
Wm. Scherzer, C. E.

## Problem.

Keokuk, Iowa, Feb. 18, 1886.

Editor Engineering News:

The Mathematical Problem propounded by your subscriber, Johnstown, Pa., page 109 *ante*, is incomplete, inasmuch that he does not give the dimensions of the circular field from which one acre is to be taken.

W. C. Stripe.

## Coal Mining in the Hocking Valley, Ohio.

Columbus, Ohio, Feb. 23, 1886.

Editor Engineering News:

The mines are all drift mines, and some new ones are being opened. Previous to the present management, the parties to whom coal land was leased, were allowed to work the mines almost entirely according to their own notions, and no one knew, after the mine began to cave, how much or what part of the coal had been taken out. Miners would claim that their entries had been driven straight, that the necks were at right angles to them, and that the rooms were regular in form. But under the present management, these claims have been investigated where it was not too late, and exact and careful measurements have been taken. The mines have been mapped, showing that while at the start the miner was doing about what he represented, yet gradually one thing or another was continually drawing him off, so that instead of his mine being arranged with regularly sized and located rooms, it was on the contrary far from it, and much of the coal was missed and lost.

Formerly the land was leased according to descriptions of the surface, such as would be made for farming purposes, conforming in the main with the lines established in the original survey of the country into sections. This has all been changed. The Hocking Coal and Railroad Company have, under the management of W. H. Jennings, their engineer, made an accurate survey of the part of the country which they own —10,000 acres—,and accurate maps, showing the outcrop of the coal and the main topographical features of the country, have been constructed. Leases are now made more with reference to these out-crops, and less with reference to section lines. Mr. Jennings sends his own assistants, trained engineers, to see that the entries and rooms are driven as they are intended to be.

In the Brush Fork mine the entries are made from 8 to 10 feet wide for single, and 15 feet wide for double entry. The necks to the rooms are driven square off from the entry, 8 feet wide and 30 feet back to the beginning of the room. The room is then opened 22 feet wider on one side of the neck, making it 30 feet wide, and is carried straight back 300 feet. A heavy pillar is left, 30 feet wide between rooms, and between rooms and entries another neck and room driven, and so on to the limit of the mine. Then the pillars are taken out, working toward the mouth of the mine, leaving the part thoroughly worked over to cave without damaging the remaninder of the mine. In other cases, heavy pillars have been left along the entries, and only left 8 feet thick between rooms; but the results are not so satisfactory as when they are left heavier. Every month the measure is taken of the roooms or entries, wherever work has been done, the work corrected, where wrong directions have been taken, and the map of the mine extended, the amount worked out between dates of measurement being blocked on to previous work, and the dates affixed to each block line, and where a mine is extensive and worked a long time, the blocks showing each season's work are colored with different tints or colors. In this way, the company hopes to be able to thoroughly work their territory.

But this is not all that is done. By carefully studying and examining the work, the engineer has been endeavoring to determine how close the actual output in tons can be calculated from the survey measurements. The figures for the work of one mine in 1885 are as follows:

| | Tons. | % lump coal. | % nut coal. | % pea coal. |
|---|---|---|---|---|
| Mine weight..... | 94,228 | 82.4 | 11.2 | 6.4 |
| R. R. weight..... | 94,275 | 82.1 | 11.9 | 6.0 |
| Calculated wt.... | 94,479 | 81.0 | 13.0 | 6.0 |

This company, as the above figures show, is fast bringing the working of a coal mine very close to an exact science.

The weighing of the coal is an interesting operation. An engine forces a number of cars up to the top of a slight summit, and the cars are then loosed one by one, and allowed to run down from the summit on the opposite side, about as fast as a mare walks at an ordinary gait, over the scales, with only room enough between for the forward car to clear the scales, before the car following strikes them; and yet not only did the young man at the arm take down the number of the car and get the total weight of the car and contents, but often takes down also, I am informed, the marked weight of the car. The work requires a quickness of eye and hand that can only be gained by long experience.

An Occasional Correspondent.

## DuBois Graphical Statics.

Cleveland, O., Feb. 24, 1886.

Editor Engineering News:

In reply to G. J. S. in the News, February 13th, I would say I fully endorse the sentiments of Charles J. Bates, of New York, relative to A. J. DuBois' treatment of "Graphical Statics." DuBois is unusually clear, and his "Strains in Framed Structures" should be in every engineer's library.

Yours,
John L. Culley.

## Extracting Square Root.

Lerdo, Sonora, Mexico, Feb. 8th, 1886.

Editor Engineering News.

The following process for finding the square root of a number may be of interest to some readers. It is the reverse of the process of "cross multiplication." I have used it several years, but have never seen it printed, and do not know of any one else using it.

To find for example the square root of 73, these are all the figures that need to be set down. The first figure in the root is 8 and the other figures are found by dividing each of the remainders 90, 75, 70 and 4 by twice 8.

73. (8.5440 +
90
75
70
4

The mental process can be illustrated as follows:

$8 \times 8 = 64$ — 73 — 90
$2 \times 8 \times \underline{5} = 80$ — 100
$5_2 = 25$ — 75
$2 \times 8 \times \underline{4} = 64$ — 110
$2\,(5 \times 4) = 40$ — 70
$2 \times 8 \times \underline{4} = 64$ — 60
$4_2 + 2\,(5 \times 4) = 56$ — 4

The underscored figures are the figures in the root, and the next figure will be 0, and the remainder 4 is to be divided by twice 8.

To show the connection of this process with that of squaring numbers by "cross multiplication," the following "cross multiplication" of 8.544 might be added. $4_2 = 16$. $1 + 2\,(4 \times 4 = 33$. $3 + 2\,(5 \times 4) + 4_2 = 59$. $5 + 2\,(8 \times 4) + 2\,(5 \times 4) = 109$. $10 + 2\,(8 \times 4) + 5_2 = 99$. $9 + 2\,(8 \times 5) = 89$. $8 + 8_2 = 72$; the underscored figures are the figures in the square (reversed), that is $8.544_2 = 72.999936$.

J. R. Hudson.

## Ohio News.

On February 19th, the plans for a county jail and sheriff's residence at Kenton, O., which had been prepared by J. C. Holland, architect, Topeka, Kansas, were adopted. Plans were presented by three other architects.

A county ditch, estimated at about $1,800, comes before the county commissioners of Hardin county for hearing on assessments, on the 10th of March.

All bids for stonework for the bridge over the Maumee river at Bucyrus have been rejected. The contract for the super-structure will probably be awarded to either the Mt. Vernon Bridge Company, the Morse Bridge Company, or the Smith Bridge Company. The other plans have been rejected. The masonry will be offered for sale again on March 26th.

Xenia has accepted the proposition of John P. Martin & Co., to erect water works in that city. The system adopted is the direct pressure and standpipe systems combined. The company agrees to lay 15 miles of pipe, put in two compound duplex pumps, with a capacity of 3,500,000 gallons per day, establish not less than 200 double delivery non-freezing fire hydrants, and furnish water for the hydrants, fire department buildings, city buildings, all public and private schools, churches, flushing the sewers and gutters, and two fountains, for $7,500 per year.

The commissioners of Shelby county recently contracted with the Morse Bridge Company for a bridge over the Miami, near Sidney, at a cost of $7,354. Bids for other bridges over Laramie creek were rejected.

The stock holders of the proposed Zanesville and New Comerstown Railway met last week, elected Willis Bailey, President; D. B. Linn, Secretary, and appointed Edmund Turner Civil Engineer of the road. The survey will begin at once.

The City Council of Zanesville are considering the idea of lighting the city with electricity instead of gas.

The average depth of ten oil and gas wells at Lima is 1282.9 feet, the depth varying from 1,231 to 1,345 feet.

An interstate convention of coal miners and operators was held in Columbus during the past week. Ohio, Indiana, Illinois, Pennsylvania and West Virginia were represented. The object of the convention was the adoption of a schedule of prices. The first day's session was a stormy one. The meeting was a peculiar one, in that for the first time two classes of men met, who have not seen proper heretofore to settle their differences by resort to conference or conciliatory measures, in sufficient numbers to satisfactorily transact business. The second day of the meeting, however, opened with a general desire for harmony and business. A conciliatory address was made by W. P. Rend, of Chicago, in which he reviewed the work that had been done in arriving at the present point, and counselled against opening up a detail consideration of the scale of prices. The scale was not perfect, but it was about as good as they could do. Some operators had refused to take part in the convention, but they would soon be glad to do so, three-fourths of the miners west of the Alleghanies being represented in the convention, and it was now no time to hesitate or turn back. There were really no difficulties which they could not brush away, and if they adopted the schedule it would be one of the grandest measures of their lives, and if they succeeded they would have established the great principle of arbitration, which would thus be the watchword instead of riot, bloodshed and incendiarism.

After a general discussion, a vote was taken on the schedule, and 39 out of the 40 entitled to vote under the rules, cast their votes for the schedule. With certain fields in Illinois thrown out, the following is the schedule: Pittsburg, 71 cents per ton; Hocking Valley, 60 cents; Indiana block, 80 cents; No. 1 Indiana bituminous, 65 cents; No. 2, Indiana bituminous, 75 cents; Wilmington, Ill., 95 cents; Streator, 80 cents; Grape creek, 75 cents; Des Moines, Io., 90 cents. In West Virginia, the prices in the Kanawha district were restored to 75 cents; Reynoldsville, Fairmount screen coal, 71 cents. In anticipation of local troubles as to the adjustment of the scale, the following resolution was adopted:

*Resolved*, That a board of arbitration and conciliation, consisting of five miners and five operators at large, and one miner and one operator from each of the coal producing states represented in the scale, be elected by the convention, and that all questions of an interstate or national character be submitted to this board for adjustment; and that we would also recommend that the miners and mine operators of each of the several states proceed at any early date to elect similar boards of arbitration and conciliation, to whom all questions of state importance shall be referred for adjustment.

After the appointment of the board, the convention ordered full proceedings of their transactions printed in pamphlet form for distribution among miners and operators, and then adjourned with the greatest of good feeling prevailing.

In order that the results might not be temporary, the convention provided for another meeting on the second Tuesday in February, 1887, for the revision, if necessary, of the present scale of prices.

## Illinois and Indiana News.

Altamont, Ill., has organized a building and loan association with a capital stock of $100,000.

The citizens of Taylorsville, Ill., have subscribed $5,000 for the purpose of sinking a coal shaft.

The citizens of Colfax, Ill., have decided to purchase a Town Hall.

There is talk of erecting a $100,000 hotel at Bloomington, Ill.

The Bloomington, Ill., Electric Light Company has filed a certificate of increase of capital stock from $30,000 to $80,000.

The new iron bridge at Keithsburg, Ill., built by the Central Iowa R. R., has been formally opened.

Marcus M. Towle, Mayor of Hammond, Ind., who recently obstructed a mail train by opening a drawbridge, has been fined $25 and costs.

Illinois has a greater railroad mileage than any other state in the Union, the total length of the tracks reaching 11,396 miles. Iowa follows with 9,636.

The Louisville, New Albany & Chicago Railroad has purchased the east end of the narrow gauge line from Bedford to Bloomfield, Indiana. It is stated that a company is to be organized to build a road ten miles in length from Bedford, Ind., to the Ohio & Mississippi R. R.

W. E. Seipp, formerly of Lincoln, Ill., has been superseded as superintendent of the gas works there by Willard Parritt, who was his predecessor.

The artesian well at Henry, Ill., has been completed at a cost of $2,710. It is 1357 feet deep and has a flow of 200 gallons per minute.

The Chicago Court House, which cost $3,000,000, is crumbling to pieces. A block of stone, weighing 120 pounds, fell from the fourth story recently, and the main entrance has been fenced in, as have also the sides on Clark, Randolph and Washington streets.

The State of Illinois has convict labor for rent at Joliet; but nobody wants it. The officers of the penitentiary have advertised that the convicts will be let out for labor, but there are no bidders.

At the meeting of the Chicago City Council the salary of the Superintendent of Streets was increased from $2,400 to $3,000. The Clark street bridge was awarded $10,000 for repairs, and this made the sum appropriated for bridges and viaducts $75,000.

Reports from Odell, Ill., state that the prospecting for gas there has been so far successful as to warrant the shipment from Pennsylvania of more extensive and expensive machinery than was on the ground, and those interested have reasonable assurance of success in their undertaking.

The contract for a bridge over the Illinois river south of Spring Valley has been let, and a bridge and road to cost not less than $60,000 will be constructed next summer. A large grain elevator will be built at the junction of the two roads there.

The Kaskaskia river, swelled by the melting snows, overflowed its banks at Shelbyville, Ill., a few days ago and inundated the site of the new water works. The engine-house and machinery stood half submerged, and forty men were thrown out of employment. Much damage was done to fences and bottom-land wheat-fields.

Mr. M. McCabe, civil engineer, for some years with the C. A. R. R., has opened an office at Pontiac, Ill., and started practice as engineer and contractor for bridge, drainage and general professional work.

The Illionis Central Railroad Company, having sold all its 4 per cent. bonds, has decided to issue $2,500,000 of 3½ per cent. gold bonds, to mature in 1951. The company has about $2,900,000 of 8 per cent. bonds maturing on July 1, 1886, and has just paid off $555,000 8 per cents which were due on Feb. 1.

There has been a rumor in railroad circles to the effect that the New York Central has been quietly engaged in buying up the general mortgage bonds of the Wabash, with a view to taking that system under the protecting wing of the Vanderbilt lines, at the sale which occurs April 26.

The amount of pavement already constructed in Springfield, Ill., is about 15 miles, of which fully 2 miles are alleys. Leaving out fractions, the rate of construction has been as follows: In 1882, 2 miles; 1883, 5 miles; 1884 5 miles; 1885, 3 miles, and projected for the present year 3 miles, which would make a total of 18 miles. Looking at the cost for the current year, there are 35,834 feet of curbing and 76,563 yards of paving to be provided for, of which the cost will be on the basis of previous rates, $149,626. Of this, $30,677 will be chargable to the city, $111,443 to private property and $6,506 to railroads. The expenditure of this sum will give a vast amount of labor and impart a great deal of activity to business.

Each of the eight electric light towers for Decatur, Ill., is 125 feet high, and weighs 6,000 pounds. The distance from corner to corner at the base is 22 feet; at the top, under the basket, only 1 foot 8 inches. The basket is 7½ feet high, and is 6 feet across. The towers rests upon solid brick foundations 5 feet deep. The main supports of the towers are made of Bessemer steel, the braces of wrought-iron, and the joints are tied and screwed firmly together with malleable iron castings. At the top of each tower will be adjusted five electric lamps. The towers were built by the Star Iron Tower Company, of Ft. Wayne, Indiana. They are the O'Bierne patent, and are in use in thirty cities throughout the coutry, all having been put up since 1880. The steam power for generating the electricity will be supplied at the water works, south of the city. The Jenney Company has an engine in position, and will install two dynamos of 30 light power each. Decatur will start with 50 lights, 50 of which are to be used on the 8 towers, and 10 to be used for the low, or mast arm lights, placed at the intersection of streets where sufficient illumination from the towers may not penetrate.

The residents of all that section of Jersey City, south of the Pennsylvania Railroad, known as Bergen and Greenville, found their water supply cut off February 27th. The trouble was caused by the ice choking up the sewer pipes. Much confusion was caused, as most of the families supposed that their water pipes were frozen up. Bandages soaked in hot water were applied to the pipes, and it was not until each family learned of the troubles of their neighbors that they realized that they were without water. In the event of a fire there would have been no means of saving property. That whole section is in peril. Seven or eight years ago a similar state of affairs existed, caused by anchor ice choking up the gate house of the reservoir. For several days a part of the city was without water. In order to prevent a recurrence of the trouble, a round about pipe, connecting with the main channel from Belleville, was laid.

## THE HISTORY AND STATISTICS OF AMERICAN WATER WORKS.

BY J. JAMES R. CROES, M. AM. SOC. C. E.; M. INST. C. E.

### 800—Cheyenne, Wyo.

Cheyenne, Wyoming Territory, in lat. 41°, 10 N., long. 104° 50′ W., is 5,900 feet above the sea on a plain which slopes quite uniformly at the rate of one foot in 120, on Crow creek, a small stream, whose source is in the Black Hills. It was settled in 1867, when the construction of the Union Pacific Railroad reached that point.

Water works were constructed by the town in 1880, taking the supply from Cross creek and pumping directly by a Knowles steam pump into about 3,000 feet of mains. In 1882 the construction of works, taking their supply by gravity from a source a mile and a half distant from the town, was begun, after the plans of W. G. Provines, C. E. Four large natural basins are situated from one and a half to two and a half miles from the town, and from 85 to 100 feet above it. The water of Cross creek was diverted into these basins, by damming the stream and cutting a canal through the bluff bordering it. Later, vitrified stone ware pipes were laid for the conduit from the stream to the basins, and between the basins. About four miles of such pipe have been laid. They are ordinarily of 20 inches diameter and laid on a gradient of 1 in 1250. In some places the grade is steeper and the pipe reduced to 15 inches diameter. The minimum depth of the pipe below the surface is five feet, and where the bluff on the creek bank is cut through, it is 33 feet below the surface. At the inlet the pipe is far enough below the surface of the pool to prevent its freezing, although the temperature has been 28 degrees below zero (F). The basins which previously contained no water, now serve as storage reservoirs. From the lowest one, a 12-inch cast-iron pipe conveys the water to the city. Distribution is by 10 miles of cast-iron pipes of 6 to 3 inches diameter, with 69 double nozzle fire hydrants and 65 gates.

The water is used very freely for irrigation of trees and lawns, being supplied to ditches along the sides of the streets. There are 240 taps. The population in 1880 was 3,456. The works cost $150,000. The bonded debt is $130,000 at 7 per cent. interest. The annual expense of maintenance is $2,500, and the revenue $10,000. The Knowles pump is retained for fire pressure. The ordinary gravity pressure in the business part of the town is 18 to 20 pounds.

Wm. G. Provines is the City Engineer.

## WATER

Steps are being taken to improve the drainage system of Guyton, Ga.

Detroit is lighted entirely by the the tower system of electric lighting, 94 towers being in use, and the expense per annum is $110,000.

Proposals for the $72,000 worth of Woodbury, N. J., bonds for the construction of the water works at that place have been awarded to Sailer & Stevenson, the Philadelphia bankers.

Manchester, Va., wants electric light, and it is understood that the electric light company in Richmond will be communicated with in regard to the matter.

A $50,000 granite dam, 250 feet across the Chicopee river, in Massachusetts, two miles above Chicopee Falls, owned by J. H. Southworth, gave way on February 21.

Nashville, Tenn., capitalists have organized a company with a capital stock of $100,000 to develop natural gas wells near that city.

The city of Wabash Water Works Co. awarded the contract for pumping machinery and boilers to the Deane Steam Pumping Company of Holyoke, Mass.

THE indications are that the paper company at Franklin, N. H., will run a 2-feet water pipe from Cross' mill to the lower mill in the spring, which will be used by the town for fire purposes.

THE West Virginia Natural Gas Company will begin at once the work of laying a natural gas pipe line to Wheeling from Washington county, Pa.

THE Mahoning, Pa., Natural Gas Company has been granted a charter. The capital stock of the company is $250,000, and the principal office is to be in New Castle.

LAST year the City of Buffalo, N. Y., purchased of the Holly Manufacturing Company, a Gaskill Compound condensing Pumping Engine, and a battery of six boilers, of the regular tubular type, each 5½ feet diameter, by 18 feet in length, set in independent furnaces, under the following guarantees. 1. A delivery of 15,000,000 gallons per 24 hours against a head of 185 feet, with a piston speed of 120 feet per minute. 2. A duty of engines and boilers as a plant, of 100,000,000 foot pounds for each 100 pounds of coal, with a steam pressure of 80 pounds. 3. A duty of engines and boilers as a plant, of 90,000,000 foot pounds per 100 pounds of coal, with a steam pressure of 80 pounds, for 1800 hours operation during a period of 90 days.

The first test of 24 hours was made December 1st. & 2nd. last, and showed a capacity at 120 feet piston speed, of 15,588,200 gallons, and a subsequent extra run of one hour was satisfactorily made, at an average speed corresponding to a daily delivery of 18,626,256 gallons, an excess of more than 24 per cent. over the guarantee.

The second trial, of 48 hours, resulted in showing an actual duty of 107,648,148 foot pounds, and this test immediately succeeded the capacity test, making a continuous run of 72 hours without a break for any purpose.

The third test of 1800 hours was completed at 7 A. M. March 1st., and the following preliminary account thereof is from the Buffalo *Express* of 2nd. instant.

AT 7 A. M. yesterday the three months' test of the new Gaskill engine was completed. Though the figures will not be made up and the average computed for a day or two, yet a glance at the daily record is enough to show that she is exceeding the promises of her builders by a handsome margin. The contract was for 90,000,000 "duty," as the technical term is, which indicates the power she is to exert with a certain outlay of coal. Only a very few times has the engine's record, made up for every "watch" of eight hours, fallen below that figure, while once on Sunday it rose to over 111,000,000. It is expected that the average will be about 100,000,000. It has been formally accepted.

THE "SUBTERRANEAN RIVER" DODGE.—CHICAGO, March 3.—A story of how a sharp speculator succeeded in inveigling the Common Council of Galesburg into buying a water works system, which is claimed to be worthless, was told in a bill filed to day in the United States Circuit Court by the City of Galesburg (Ill.) Water Works Company to set aside the contract of purchase. According to the bill one Nathan Shelton contracted to furnish the city with water from a system of wells which he was to put down. The city gave him the use of water mains already made, and agreed to take water from him. The Galesburg Water Company was accordingly incorporated with a capital of $150,000, of which Shelton kept $147,000.

Then Shelton suddenly discovered, as he said, that there was a subterranean river 70 feet under the city which was connected with the Rock river, and would give an inexhaustible supply of pure fresh water. He began to excavate a well, and built a large reservoir, which was to hold the overflow from the well. Near this reservoir was a small, filthy stream, conducting the sewage of the city and neighboring slaughtering houses, and in the night Shelton laid a pipe half a mile up the river to a drain from some fields and slaughter houses, and connected it with his reservoir and the reservoir with the well. The next day the reservoir and well were full, and the wily Shelton caused it to be understood far and wide that the subterranean river had broken out.

A test was then proposed. A few hydrants in the center of the city were opened and a hundred-foot jet of water was thrown into the air. The company served water after a fashion from December 1883, to July 1884, when the filthiness of the water led the authorities to look more closely into the source whence it came. They then discovered to their intense disgust that they had been draking the sewage of the slaughter houses, and that the creek had been dammed up by the water company, and the whole water supply furnished therefrom. Shelton was ordered to tear down the dam, and confessed that he had been taking water from the creek; that his water system was a failure, owing to the caving in of his mythical well; but stoutly maintained that no creek water had been furnished for domestic purposes. The city has rescinded its contract and filed the present bill to get possession of its pipes and cancel the agreement.—*N. Y. Times*, 4th.

**No. 9. Water Pressure in Mains of Various Cities.**

COMPILED BY J. J. R. CROES, FROM SPECIAL RETURNS, JAN., 1886.

| TOWN AND STATE. | Topography. | Difference of level in Town. | In Business District. | | Fire Pressure. |
|---|---|---|---|---|---|
| | | | Day Pressure. | Night Pressure. | |
| | | feet. | lbs. | lbs. | lbs. |
| Bridgeport, Conn. | hilly. | 150 | 60 | 60 | 120 |
| Concord, Mass. | level. | a few feet. | 48 | —— | —— |
| Detroit, Mich. | sloping. | 50 | 18 to 20 | 18 to 24 | 15 to 24 |
| Emporia, Kan. | level. | 0 | 45 | 35 | 140 |
| Evanston, Ill. | level. | 0 | 40 | 40 | 80 to 110 |
| Evart, Mich. | rolling. | 50 | 40 to 50 | 30 | 80 to 120 |
| Fair Haven, Vt. | level. | 0 | 80 | 80 | 80 |
| Fairplay, Col. | nearly level. | nearly equal. | 40 | 40 | 40 |
| Fall River, Mass. | hilly. | 160 | 75 | 75 to 120 | 75 to 120 |
| Fargo, Dak. Ter. | level. | 0 | 35 | 30 | 150 |
| Fayetteville, N. C. | level. | 15 | 15 | 15 | 100 |
| Fitchburg, Mass. | hilly. | 200 | 80 to 160 | 80 to 160 | 80 to 160 |
| Flushing, N. Y. | hilly. | 30 | 40 | 50 | 90 to 110 |
| Fond du Lac, Wis. | level. | 0 | 45 | 45 | 45 to 150 |
| Fort Plain, N. Y. | hilly. | 140 | 80 | 80 | 80 |
| Fort Scott, Kan. | rolling. | 0 | 25 | 25 | 60 |
| Forth Smith, Ark. | level. | 0 | 50 | 50 | 85 |
| Fort Wayne, Ind. | hilly. | 25 | 40 to 45 | 40 | 100 |
| Frackville, Pa. | level. | 100 | 50 | 50 | —— |
| Franklin, Mass. | rolling. | 100 | 70 | —— | —— |
| Franklin, Pa. | hilly. | 50 | 50 | —— | 50 |
| Fredericton, N. B. | level. | 0 | 40 | 25 | 70 to 90 |
| Fredonia, N. Y. | hilly. | 20 | 105 | 110 | 105 to 110 |
| Fremont, Ohio. | hilly. | 37 | 45 to 50 | 50 | 80 to 100 |
| Freeport, Pa. | hilly. | —— | 85 | 90 | —— |

THE city of Jacksonville, Fla., has just completed a third artesian well, which flows about 50,000 gallons an hour. This increases the city water supply to nearly 3,000,000 gallons a day. The water is warm and somewhat sulphureous, but loses the bad taste, to a considerable extent, on being exposed to the air.

The municipal authorities of Mobile, Ala., have accepted the bid of the Brooklyn Electric Lighting and Construction Company to furnish a plant and machinery complete that will be placed in the market on Royal street, and is expected to be in operation within three months.

SUNBURY, Pa., February 26.—A stock company has been formed here by prominent men for the purpose of boring for natural gas at Snydertown, about five miles distant. They claim that oil men have inspected the ground and say the indications are good for a successful termination of the venture.

A PROJECT is now being forwarded to locate and operate a 2,000-candle-power electric light on each of the twenty-four public bridges in Milwaukee, Wis. If carried out, this will give to Milwaukee's harbor the best illumination of any on the lakes.

THE Tuerk Hydraulic Power Co., manufacturers of the popular Tuerk Water Motor, has closed the Chicago office, and opened an office in this city, at 12 Cortlandt street, where the General Manager of the company, W. H. Marsh, makes his headquarters. The factory and western office remain at Sycamore, Ill.

THE city of Philadelphia has commenced a suit to recover about $40,000 from Thos. R. Brown, ex-chief engineer of the city gas works, that being the difference between the list price of castings, pipe and other materials purchased by him and the actual market price after making the discounts invariably allowed, from which it is alleged the city derived no benefit.

NEW ORLEANS has 528 pole lights at street corners, and 40 towers of five lamps each, back of the town. The apparatus of the Jenney Electric Light Company there is the most extensive in the world; it consists of twenty engines, each 100-horse-power, and 40 dynamos of thirty lights each. In the business portions of New Orleans the pole, or mast, lights are placed at every intersection.

A STEAM pumping station is proposed to be established in North Minneapolis for use in cases of emergency and should the growth of the city require it, it may ultimately be utilized for the regular supply. The plan is to put in two pumps of 6,000,000 or 8,000,000 gallons capacity.

## NEWS OF THE WEEK.

### CONTRACTING.

**Dubuque & Northwestern R. R.**—Larson & Co., the contractors, have sublet contracts for the building of that road from Hayfield, Minn., to Oelwein, Iowa.

**Michigan Soldiers' Home.**—Contractor Tiedke has let a contract to the Zeeland Brick and Tile Company for 1,000,000 brick, and to an Ionia firm for the same number.

**Laying Water Mains.**—Proposals will be received at the Department of Public Works, 31 Chambers street, until March 9th, for laying water mains in various streets and avenues.

**Metropolitan Elevated R. R. Suit.**—The case of the New England Iron Company against the Metropolitan Elevated Railway Company for breach of contract, involving about $4,000,000, and which has been in litigation since 1878, has just been compromised for $250,000.

**Street Improvements.**—On March 26th, the Board of Public Works of Cincinnati, O., will open a large list of proposals for street improvements, now being advertised in the *Enquirer* of that city.

**Heating and Ventilating.**—The Detroit, Michigan, Board of Public Works has awarded the contract for heating and ventilating the new City Hall to the Detroit Metal & Heating Works, their bid being the lowest at $11,909.81. Sproul & McGurrin of Grand Rapids were the highest bidders at $16,301.62.

**Yellow Pine Cross-Ties.**—Messrs. Dill & Son, contractors of the East Georgia and Florida R. R., have just closed a contract for some 10,000 acres of heavily timbered Georgia yellow pine land, from which to cut cross-ties for the entire road.

**Work Rejected.**—We hear that some of the work done under the recent building contracts of the asylum, was rejected by the State Board of Charities, at their last meeting at the asylum. The contractors will be compelled to take down and rebuild. Osawatomie, Kan., *Sentinel*.

**Bridge.**—Superintendent of Public Works Shanahan has awarded the contract for the Pinnacle avenue, Rochester, bridge to the King Iron Bridge and Manufacturing Company of Cleveland, O., for $2,631. The other bids were: Alden & Lansig, Rochester, N. Y., $2,749; Hilton Co., Albany, N. Y., $2,748; Van Zile & McCormack, Albany, N. Y., $3,200.

**Railroad Contract.**—The contract has been let in Milwaukee for the extension of the Wisconsin and Michigan Railroad (Milwaukee and Northern) from its present terminus at Pike, Wis., to Iron Mountain, Mich. The distance is about twenty-five miles in a nearly straight line north.

**Stone Block Paving.**—The Panhandle R. R. has awarded the contract for paving High street, Columbus, O., in front of their property with Ligonier stone block to Booth & Flinn, of Pittsburg. Twelve other large holders of High street property have also closed contracts with the above firm. The work must be equal to that on Wood street, Pittsburg.

**Water Pipe and Castings.**—The Lake Shore Foundry, of Cleveland, O., has received the contract for furnishing that city with water pipe for the ensuing year. For 3,800 feet of 30-inch cast-iron pipe the price was $24.80 per ton. For all small pipe $25.50 per ton. For the 30-inch special castings, 3¼ cents per pound. For smaller pipes special castings, 2¾ cents per pound.

**Dredging.**—Williams, Upham & Co., of Duluth, Minn., have secured a contract for dredging the new St. Paul & Duluth R. R. slip, and also for the filling of the new coal dock. The firm also has the contract for the filling of the new Omaha dock. The work will begin as soon as the ice gets out of the harbor, which will not later than May 1.

**Narrow Gauge Railroad Contracts.**—GREENVILLE, S. C., February 26.—Two sections of the Narrow Gauge Railroad were let to-day. The one extends from Ninety Six, sixteen miles northward, and is light work. This was awarded to W. E. Sullivan, of Greenville. The other extends eleven miles further toward Greenville, to a point in Laurens county. This includes the heaviest work and was awarded to Alexander Stewart & Co., of Tennessee. Sullivan is to begin work by March 15, and complete the grading within ninety days. Stewart & Co. to begin by March 20, and complete the contract within four months. Other sections of the road from here to Ninety-Six will be let in April.

**Contracts vs. Railroad Company.**—Texas & St. Louis Railway Company vs. Donelly, Arkansas, 1886. —Donelly built several sections of the railroad. The railroad company contracted for the construction of the road with one Hibbard. Donelly made a verbal contract with Stephens, the civil engineer of the road, and the question at issue was whether Donelly could collect from the company or Hibbard. The lower court held that the engineer of the road was its legal representative and gave judgment to Donelly for $511.68. Held: That though the company may have contracted with Hibbard to build the entire road, that did not prevent it from entering into contract with other parties to do the work in part or in whole. As Stephens was recognized as an official of the road, empowered to make contracts, and as much of the work done by Donelly was paid for upon orders of Stephens, the road could not go behind the Hibbard contract and claim no liability to Donelly on account of it.

## Railroads and Canals.

**St. Catharine & Niagara Central R. R.**—Work has been commenced on this line.

**The Erie R. R.** is about to erect commodious depot buildings at Jersey City.

**Buffalo & Geneva R. R.**—Two corps of surveyors are at work lining out the road. The first corps surveys from Geneva to the Genesee river to Buffalo.

**A Florida Railroad.**—A company has been incorporated for the purpose of building and operating a railroad from Apalachicola to St. Andrews' bay, Fla.

**The New York and Boston Inland Railroad Company** has been granted an extension of time in which to build its road.

**The Jacksonville, Tampa & Key West R. R.** was formally opened between Jacksonville and Sanford Feb. 22d, completing the last link of a direct all rail route from New York to Tampa, Fla.

**The Lachine Bridge.**—Work has been commenced on the Canadian Pacific R. R. bridge across the St. Lawrence at Lachine rapids. It is to be ready for traffic next year.

**Chicago and Northwestern R. R.**—The extension from Fremont to Lincoln, Neb., is to be rapidly pushed. The grading contractors are under bonds to get the road ready for track-laying by June 1.

**St. Louis & San Francisco R. R.**—This road intends to construct a branch from Fort Smith to Dallas, Texas. The first part of its line between Albuquerque, N. M., and Red Fork, I. T., is to be commenced soon.

**Railroads in Virginia.**—The total railway mileage built in Virginia since January 1, 1881, is 305 miles, and its cost, including the development and improvement of old roads, amounts to $75,000,000.

**Stone Arch Bridge.**—The citizens of Anoka, Minn., contemplate the erection of a new stone arch bridge, the present one being deemed unsafe. A petition is being circulated, and is meeting with a very favorable reception.

**Market Street Bridge, Philadelphia.**—Philadelphia would like to have several new bridges over the Schuylkill, but the Finance Committee of Councils says the city treasury cannot stand the strain of building more than one—a new structure of iron and steel to replace the old Market street bridge.

**The Chicago, Milwaukee & St. Paul R. R.** has purchased the franchise of the Dakota & Great Southern R. R. It is said the Milwaukee will construct at once, under this purchase, an extension from Andover to a point eighteen miles south of Lisbon.

**The Railroad Construction Company of West Virginia** has been incorported by P. H. Morris, Bristol, Pa.; William Stiles, Camden, N. J.; M. Van Hartingen, George W. Edwards, and D. Dodson, Philadelphia. Capital stock, $1,000, with privilege of increase to $1,000,000. It is authorized to build railroads, bridges, water and gas works, etc.

**Minneapolis and Sault Ste. Marie R. R.**—H. H. Holldge, of the engineering corps, states that the line has been permanently located to a point within seven miles of Rhinelander on the Wisconsin river, and Capt. Rich, the chief engineer, is making arrangements to continue the surveys to a point about twelve miles east of Rhinelander.

**The Duluth, Huron and Denver Railroad Company** has filed articles of incorporation. The company will construct and operate a line from Duluth in a southwesterly direction to Denver, Col. The principal place of business will be in Huron, Dak. Capital stock, $1,000,000. The incorporators are, F. J. Hodgson, St. Paul; John P. Conkly, Dubuque, Iowa; E. P. Caldwell, C. M. Harrison, Leslie Dunley, Huron, Dak.; F. T. Day, Milwaukee; T. C. Day, Indianapolis; C. E. Mabie and F. C. Platt, Waterloo, Iowa. It is proposed to have the road in operation as soon as possible, and the preliminary surveys are made. Operations will be commenced as soon as the weather will permit. During this season a line will be built from Huron, Dak., to Sauk Center or Benson, or to Willmar, and next year the road will probably extend to Duluth. Construction will begin in Minnesota.

**Insecure Railway Charters.**—The Attorney-General of Minn. has filed with the clerk of the Supreme Court an information for the purpose of procuring a writ in the nature of a *quo warranto* to forfeit the charters and dissolve the corporations of the following railroads: The Hastings and Dakota; Minnesota Central; Southern Minnesota; Southern Minnesota Railway Extension and the St. Paul and Sioux City upon the ground that they have each sold the railroad for the building and maintaining of which they were incorporated, and that they have each suspended their lawful business and have not executed any of their franchises since the conveyance of the road, and that they are kept in existence for the sole purpose of holding their land grants exempt. The writs call for reversion to the State of the lands retained under each charter.

**A Far Rockaway Railroad.**—The gentlemen who recently contracted with the Brooklyn Elevated R. R. for the use of its track from the ferry to VanSicklen avenue, in East New York, as a connection with a road to be built by them from that point to Far Rockaway, have sent their articles of arrangement to Albany. The names of the incorporators appended were: John D. Cheever, David L. Haight, Joseph H. Auerbach, John H. Cheever, Ebenezer Roby and others. It is proposed to build sixteen miles of road and to equip and operate in the best possible manner. Final details are now under way. The three routes surveyed are under consideration, and with the opening of spring work will begin. The capital stock of the company is set at $1,250 000 in $1,000 shares, and the directors named are: John H. Cheever, David L. Haight, Joseph S. Auerbach, Edward Harriman, John D. Cheever, D. H. King, Jr., Ebenezer Roby, W. A. Wynn, E. A. Brinckerhoff, N. T. Lawrence, W. H. Stevenson, C. F. Stone and C. F. Richards.

**Chicago, Burlington & Northern R. R.**—Wells, French & Co., of Chicago, are pushing the work on the Howe truss bridges across the slough opposite Winona, Minn. There will be three spans, each 150 feet in length. W. H. H. Spafford has his contract completed from the Wisconsin road to the Chippewa river. Track material is accumulating at La Crosse, and there is now piled up in the yards 110 miles of steel rails, sufficient to lay the track from Prairie du Chien to Winona. The tracklaying machine has commenced work from La Crosse northward, and it is designed to have the track laid to Winona by April 1. The material for the iron bridge over the Chippewa Valley R. R., opposite Wabasha, has been delivered. Riprapping is progressing satisfactorily between Winona and the Trempealeau mountain.

**The Columbus, Nebraska & Wyoming Railway Company** has been organized and articles of incorporation filed at Lincoln, Neb. The line will be built northeast through Lancaster county and will be in operation this season.

**Atlantic & Pacific Ship Canal Co.**—A member of the Nicaraguan Government says the Atlantic and Pacific Ship Canal Co. is an extinct corporation, all concessions having been revoked and their steamers and other effects sold at auction in the year 1860, under a decree of the courts.

**Texas & St. Louis R. R.**—The Missouri and Arkansas division was sold at public auction in St. Louis on the 27th, to Eleniars Smith, representing the bondholders of the road for $7,401,000. G. H. Tenbroke, of New York, representing eastern capitalists, offered $7,400,000, over which figure his instructions, he said would not allow him to bid.

**Passengers on Freight Trains in Prussia.**—The Prussian Minister of Public Works has directed that in cases of pressing necessity passengers may be carried by freight trains, in the conductor's car. The passenger must have a first-class ticket and in addition pay the sum of 73 cents, which will make it sure that no one will ride unless there is indeed pressing necessity.

**The Sea Cliff Elevated Railroad Company**, Long Island, has been organized to build and operate an elevated railroad from the Sea Cliff station to the "Cliff," a distance of two-and-a-half miles. They also intend that the engine used in operating the railroad, which will be a cable-road, shall run the dynamo to furnish the village with electric lights.

**Northern Pacific R. R. Tunnel.**—Work has commenced on the big Northern Pacific tunnel, in Stampede Pass, California. Fifty men are at work at the mouth of the tunnel. Two hundred men will be required to build the approaches and cut through the rocks at the east portal. When boring is commenced about 700 men can be utilized at each end, and they will work on eight hour shifts.

**Railroads in Kansas**—There are twenty-seven railroads in Kansas—railroads in name. But they are all owned and operated by the three great systems of the west, as follows: The Atchison, Topeka & Santa Fe R. R. owns and operates twelve; the Missouri Pacific R. R. owns and operates six, and the Union Pacific R. R. owns and operates nine. There is not a single railroad in Kansas—not a foot of road—operated by a local company.—Leavenworth *Times*.

**A Maine Central R. R. Extension.**—A railroad from Skowhegan to Athens, Me., is projected. Citizens along the line have raised between $10,000 and $50,000. Well-known railroad contractors have offered to build a first class road with street rails, all ready for rolling stock, for $15,000 per mile, taking in payment the cash subscribed, and the bonds of the road for balance, providing the Maine Central Railroad Company will guarantee the interest. This would virtually be an extension of the Maine Central system to Athens. From Athens to Moosehead lake is about forty-five miles, and it is said that contractors are willing to build the road to the lake at the same price per mile, provided the Maine Central R. R. will guarantee interest on the bonds.

**Canadian Railroad Schemes.**—The coming session in the Dominion House of Commons is likely to be largely taken up with railroad legislation. Forty-one notices have already appeared in the *Canadian Gazette* for charters for existing railways or for amendments to existing charters, all of which are to be asked from Parliament at the next session. Of these, four relate to railways in the maritime provinces, two in Quebec, seventeen in Ontario sixteen in Manitoba and the Northwest Territories, and three in British Columbia. Fully half of the total number are for new ventures. Of these, the most important to Americans are the three lines that are intended to tap the trade of the Western States and bring it across the Canadian territory. It is now certain that the line from Winnipeg to Hudson's Bay will be built. The capital has, it is said, already been subscribed, and the promoters promise that the route will be in working order in two years.

**Michigan Railroad News.**—The Marquette, Houghton & Ontonagon R. R. will extend its line forty miles from L'Anse to Ontonagon this season. The Canada, La Crosse & Southwestern R. R. has a line surveyed through the upper peninsula as has also the Sault Ste. Marie road. The Chicago & Northwestern R. R. is accredited with designs on the Republic iron district by means of a three mile spur from Fish mountain. The Milwaukee, Lake Shore & Western R. R. will go still farther into the Gogebic mining district. The Wisconsin Central has an eye on the Gogebic territory, and if it builds to Bessemer, great ore docks must be constructed at Ashland. The Hancock & Calumet R. R. (narrow gauge) is completed, and the Mineral Range R. R. is just completing a large drawbridge over the Portage.

# Market Report of Engineering Materials.

**New York March 4, 1886.**

NOTE.—The following Market Report gives wholesale prices on the New York Market unless otherwise stated. It is intended as a general guide to the estimating engineer. We give it with this caution, that, as is well understood in business transactions, the amount of bill, distance from market centre and conditions of payment will have a material influence on the final paying prices.

## IRON.

| | | | |
|---|---|---|---|
| STRUCTURAL IRON. | | | |
| Angles | 2.00c | @ | 2.10c |
| " steel | 2.35 | @ | 2.45 |
| Tees | 2.35 | @ | 2.40 |
| Beams and channels, American | 3.0 | @ | |
| Tank Plates | 2.0 | @ | 2.1 |
| Shell Plates | 2.4 | @ | 2.5 |
| Steel plates, Tank | 2.5 | @ | |
| WROUGHT-IRON PIPE. PITTSBURGH. | | | |
| Butt welded, black Discount | 42½ | @ | 45 |
| " " galvanized " | 32½ | @ | 35 |
| Lap welded black " | 60 | @ | 62½ |
| " galvanized " | 42½ | @ | 45 |
| Boiler tubes " | 55 | | |
| RAILS. | | | |
| Steel (large lots at mill) | $34.00 | @ | $34.50 |
| Old rails | 21.50 | | |
| Old rails, steel | 22.00 | @ | 23.00 |
| R R. spikes | 2.40c. | | |
| R R. splice-plates | 2.00 | | |
| R R. track bolts, square nuts | 3.00 | | |
| Barb-wire fencing, galvanized | | | 5.00 |
| " " painted | | | 4.00 |
| Corrugated iron | | | |
| Nails | | | |
| Iron, per keg | | | 2.55 |
| Steel do. | | | 2.75 |

## METALS.

| | | | |
|---|---|---|---|
| COPPER. | | | |
| Lake Superior | $11.40 | @ | 11.50 |
| Other Brands | | | 10.12 |
| LEAD. | | | |
| Com. Domestic | 4.65 | | 4.70 |
| Lead Pipe | .06¼c. | | |
| Tin-Lined Lead Pipe | .15 | | |
| Sheet Lead | .07¼ | | |
| ZINC. | | | |
| Sheet | $5.10 | @ | 5.20 |

## BRICK.

| | | | |
|---|---|---|---|
| Cargoes (afloat) | | | |
| Haverstraw per M. | | | |
| Fishkill | | | |
| Up-River | | | |
| Jerseys | 7.75 | @ | 7.35 |
| Long Island | 7.50 | | |
| Pale | 4.50 | | |
| FRONTS. | | | |
| Croton, red | 11.00 | @ | 14.00 |
| " dark | 11.00 | @ | 14.00 |
| " brown | 10.00 | @ | 13.00 |
| Philadelphia pressed | 24.00 | @ | 25.00 |
| Trenton " | 24.00 | @ | 25.00 |
| Baltimore " | 37.00 | @ | 41.00 |
| Buff " | 33.00 | @ | 35.00 |
| Enameled English | 65.00 | @ | 130.00 |
| " American | 85.00 | @ | 120.00 |
| Fire brick | 24.50 | @ | 55.00 |

## CEMENT.

The following price current is made up entirely from quotations furnished us directly by the firms dealing in each brand; the prices are understood to be wholesale in New York, subject to such special rates as large quantities may warrant:

| | | | |
|---|---|---|---|
| Alsen's Portland Cement Works | $2.50 | @ | $3.00 |
| BAETJER & MEYERSTEIN: | | | |
| Hanover Port.and | 2.60 | @ | 2.65 |
| BELLONI & Co.: | | | |
| Hemmoor "Crown" brand | | | 2.50 |
| JAMES BRAND: | | | |
| K. B. & S | 2.55 | @ | 3.00 |
| BROOKS, SHOOBRIDGE & Co. | 2.45 | @ | 2.60 |
| HOWARD FLEMING: | | | |
| Gibbs' English Portland, 400 lbs | 2.65 | @ | 2.90 |
| K. B. & S. " " | 2.75 | @ | 2.95 |
| Stettiner, German | 2.65 | @ | 2.85 |
| Lagerdorfer, " | 2.45 | @ | 2.75 |
| Fleve, A 1, Belgian | 2.35 | @ | 2.50 |
| Roman | 2.75 | @ | 3.00 |
| Keene's Coarse | 4.75 | @ | 5.50 |
| " Fine | 7.75 | @ | 8.50 |
| " Superfine | 8.50 | @ | 10.00 |
| FISHER, ERSKINE W.: | | | |
| Stettin (German) Portland Cement | $2.40 | @ | 2.75 |
| GABRIEL & SCHALL: | | | |
| Vorwohler "Lion" | 2.65 | @ | 3.10 |
| HUDSON RIVER CEMENT Co. Rosendale | | | 1. 0 |
| JOHNSON & WILSON: | | | |
| Saylor's American Portland | 2.15 | @ | 2.40 |
| LESLEY & TRINKLE, Philadelphia, Pa.: | | | |
| "Giant" Portland | 2.20 | @ | 2.40 |
| Improved "Union" | 1.35 | @ | 1.50 |
| Union | 1.10 | @ | 1.20 |
| MARCIAL & Co.: | | | |
| J. B. White & Bros. Coarse | 4.50 | @ | 5.00 |
| " Fine | 8.00 | @ | 10.00 |
| " Portland | 2.45 | @ | 2.85 |
| NEW YORK CEMENT Co.: | | | |
| Rosendale | | | 1.20 |
| N. Y. & ROSENDALE CEMENT Co.: | | | |
| Rosendale, "Bridge" brand | | | 1.10 |
| SINCLAIR & BABSON: | | | |
| K. B. & S. | 2.35 | @ | 2.60 |
| STANDARD CEMENT Co, | | | |
| E. THIELE: | | | |
| Dyckerhoff | 2.90 | @ | 3.25 |
| UNITED STATES CEMENT Co.: | | | |
| Windsor | 1.00 | @ | 1.10 |
| Standard | | | 1.15 |
| Old 'a Portland | 2.15 | @ | 2.40 |
| UNION AKRON CEMENT Co.: | | | |
| Akron "Star" brand. | | | |

## ASPHALT.

| | | | |
|---|---|---|---|
| Prices range per ton | $15.00 | @ | 20.00 |
| According to quantity or brand, and whether taken from vessel or store. | | | |

## LIME.

| | | | |
|---|---|---|---|
| Rockland, common per bbl | 1.00 | | |
| " finishing | 1.20 | | |
| State, common | .90 | | |
| " finishing | 1.10 | | |
| Kingston, ground | 95 | @ | 1.00 |
| Add 25c. to above figures for yard rates. | | | |

## STONE.

*Cargo rates at New York.*

| | | | |
|---|---|---|---|
| Amherst freestone, No. 1 per cub. ft. | 0.95 | @ | 1.00 |
| " " No. 2 " | 0.75 | @ | 0.85 |
| " " light drab " | 0.80 | @ | 0.95 |
| Berlin " in rough " | 0.75 | @ | 1.00 |
| Berea " " " | | | |
| Brown stone, Portland, Ct. " | 1.00 | @ | 1.35 |
| " Belleville, N. J. " | 1.00 | @ | 1.35 |
| Granite, rough | 0.45 | @ | 1.25 |
| Common building stone per load | 2.00 | @ | 3.00 |
| Base stone, from 2¼ to 6 ft. lengths, per lin. ft. | 0.40 | @ | 3.00 |

## SLATE.

| | | | |
|---|---|---|---|
| Purple roofing per square. | 6.00 | @ | 7.00 |
| Green " | 6.00 | @ | 7.00 |
| Red " | 15.00 | | |
| Black Penna. (at New York) " | 4.80 | @ | 5.00 |

## LUMBER.

Prices for yard delivery in New York.

| | | | |
|---|---|---|---|
| PINE, Common box per M. | 18.00 | @ | 20.00 |
| " Choice " | 65.00 | @ | 70.00 |
| Tally plank, 1¼ in.10 in. dres'd, each. | .44 | @ | .50 |
| Tally boards, dressed com. " | .28 | @ | .30 |
| SPRUCE, Boards dressed " | .25 | @ | .28 |
| Plank, 1¼ in " | .28 | @ | .30 |
| " 2 in. " | .38 | @ | .40 |
| " 2 in. dressed " | .43 | @ | .45 |
| Timber per M. | 20.00 | @ | 22.00 |
| HEMLOCK, Boards each. | .18 | @ | .20 |
| Joist, 2¼ × 4 to 4 × 6 in | .16 | @ | .44 |
| OAK per M. | 55.00 | @ | 65.00 |
| CYPRESS 1, 1¼, 2 and 2¼ in " | 35.00 | @ | 40.00 |
| YELLOW PINE, Girders " | 25.00 | @ | 30.00 |
| Dressed flooring " | 28.00 | @ | 35.00 |
| SHINGLES, Extra shaved pine, 16in. " | | | |
| " sawed 18 in. " | 5.75 | @ | 6.00 |
| LATH, Cargo rate " | 2.35 | @ | 2.40 |

## PAINT.

| | | | |
|---|---|---|---|
| Lead, white, American dry per lb | .04½ | @ | .06 |
| " " " in oil pure " | .06½ | | |
| " English, B. B. in oil " | .08½ | @ | .08¾ |
| " Red, American " | .05¼ | @ | .05½ |
| Litharge " | .05 | @ | 05½ |
| Venetian red, American " | .01 | @ | .01¼ |
| Indian red " | .05 | @ | .10 |
| Vermillion, American lead " | .10½ | @ | .12½ |
| Paris green " | .15 | @ | .20 |
| Umber, Amer. raw and powdered per lb. | .01¼ | @ | .01¾ |
| Drop black, Amer. " | .07 | @ | .13 |
| " " Eng. " | .11 | @ | .13 |
| Chrome green " | .05 | @ | 20 |
| Oxide zinc, American " | .03¼ | @ | .04 |
| " French " | .06 | @ | .08 |

## Trade Notes.

THE Tonawanda, N. Y., Pipe Works are to be refitted with the best machinery for the manufacture of pipe.

IN the spring an addition to the Pittsburg Locomotive Works will be erected in Allegheny.

THE Edgar Thomson Steel Works have received, from the St. Louis and Cairo R. R., an order for 15,000 tons of rails, 60 pounds per yard. The road is 132 miles long, and is to be changed from narrow to standard gauge.

THE Jarvis Engineering Co., of Boston, has received orders to set three new steel tubular boilers, for the Worcester Steel Works, with the Jarvis patent furnace. They will use screenings for fuel to be burnt on the Sheffield grates.

THE Scranton Steel Company has just received an order from the Erie R. R. for 15,000 tons of steel rails. The contract specifies that the rails shall weigh 67 pounds to the yard, and be one-fourth of an inch higher than the rails now used on the road.

THE Iron Mountain and Pilot Knob iron ore companies have this season's output already sold up. This looks well for Missouri's iron ore business, assuring, as it does, permanency of operations during the present year.

THE Gilbert Car Works, of Troy, N. Y., are building for the Utica and Black River Railroad a mammoth snow plow, which will be 35 feet long, 18 feet high, and 12 feet wide. It will weigh about 40 tons. They are also building four coaches for the Monarch Parlor Sleeping Car Company.

THE large iron foundry of Morris, Tasker & Co., at New Castle, Del., which gave employment to 1,000 hands, has been closed and is offered for sale.

THE Gordon & Maxwell Pump Co., Hamilton, Ohio, are full of business.

A STEEL floating derrick, capable of handling a weight of 60 tons and said to be the most powerful hoisting machine in the country, has been landed at Brooklyn. It was built at Wilmington, Del

AN expert in steel making, who represents the original owners of the basic steel process, has been in Chattanooga, Tenn., in the interest of capitalists who intend to establish a steel making plant in the South, and will probably erect it at that city.

MAJOR L. S. BENT, Superintendent of the Pennsylvania Steel Works at Steelton, Pa., has purchased twenty-one houses and seventy-eight lots adjoining the steel works property, and will immediately arrange for the erection of a new furnace and machine shops. The purchase money was $34,000.

THE Morse Bridge Works, at Youngstown, O., are running full. The firm have recently booked a large order from Omaha, Neb. They have the contract to build there two viaducts 1,500 feet long. About April 1st the firm will have the large bridge at Minneapolis completed.

H. C. JACKSON has been awarded the contract for the erection of the large machine and pattern shop of the Chattanooga foundry and pipe works. The building will be 40 by 125 feet, and work will be commenced at once.

AFTER a shut-down of two weeks, necessitated by much needed repairs, the King Iron Bridge Co. of Cleveland, O., have started up again. They report plenty of orders ahead, and will resume with a full force.

THE Gulf, Colorado and Santa Fe R. R. is putting a 65-horse-power Westing-house engine into the new shops at Galveston, Texas; the Florida Railway and Navigation Co. similarly, at Fernandina, 35-horse-power; and the Wabash, St. Louis and Pacific R. R., 75-horse-power, at Decatur.

A PARTY of capitalists has concluded to purchase the Manoloma, Mich., iron furnace for $25,000. A stock company with a capital of $50,000 will be formed, and Mr. E. Fitzgerald of the G. R. & I. R. R. will have the management.

AN order has been received at the Altoona (P. R. R.) machine shops for fifteen Class R locomotives. An experimental engine of that class was turned out of the shops a few years ago, and since has been thoroughly tested on all the divisions of the road. It is the largest locomotive ever built by the Pennsylvania Railroad Company and is especially adapted for hauling heavy trains on grades. This order would seem to imply that the experiments have been satisfactory, and that this class will be the standard for freight engines.

THE Sims-Edison Electric Torpedo Co. has been incorporated to manufacture, sell and use torpedoes, torpedo-boats, submarine vessels and war ships, war materials, electric machinery and instruments, dynamo machines, electric cables, wires, motors and lights, and also steam engines, boilers and supplies. The capital stock is $1,000,000.

JOHN SPRECKELS, of the Oceanic Steamship Co., San Francisco, Cal., who recently went East to make arrangements for building a new steamer, has purchased from Pearce & Co., of London, the steamers "Zealandia" and "Australia," now plying between San Francisco, Honolulu, Australia and New Zealand and chartered by the Pacific Mail Steamship Co. The price paid is said to have been $500,000.

H. K. PORTER & Co., of Pittsburg, have shipped a light locomotive to Pottsville. They have also one building for the steel works at Troy, N. Y.; another to a brick-making company on the Hudson, and have received an order for a 2-foot gauge for a community near Montreal.

ARTICLES of incorporation of the Burr & Richmond Foundry Company have been filed in the County Clerk's office, Brooklyn N. Y. The capital of the company is $30,000. The foundry will be established in Brooklyn, and the company will be managed by the following five trustees: Frederick S. Burr, James B. Richmond, Charles Hubbard, Joseph A. Taylor and Frank D. Moffat.

THE United States Consular Agent, writing on "How to Get New Zealand Trade," says: "The only difficulty which stands in the way of the more general introduction of American manufactures into this country is the want of facilities and opportunities for bringing the buyers into personal and immediate contact with the seller and his products. I would therefore suggest that intelligent representatives be sent out here to examine and ascertain the requirements of the country, and then manufacture to suit the same and send good representatives over to sell from samples."

STEEL rail manufacturers are now interested in an order for about 40,000 tons of steel rails for the 'Frisco line. Outside of Pittsburg manufacturers the Cambria and the Steelton Works and the North Chicago Rolling Mill are bidding.

A MACHINE for making tubes from hollow cylindrical metal ingots by either hot or cold rolling has been patented by S. P. M. Tasker, of Philadelphia, Pa. In conjunction with a set of concave rolls, so arranged that the rolls cross each other, there is employed a mandrel which is adapted to be rotated with the ingot upon it. The mandrel is of the length at least of the tube to be formed. It is passed through the pass of the set in a direction at right angles to its common axis.

A NUMBER of Lebanon (Pa.) capitalists have formed a company, and are now having steel works erected at Lickdale, on the line of the Lebanon and Tremont R. R. Work has been commenced on the erection of the building, which is to be almost wholly of iron. A large amount of the machinery is on the ground, and it is expected that in about sixty days the building will be completed. The company will give employment to from one hundred and fifty to two hundred men.

FAIRBANKS & Co., St. Louis, report an increased business. They are now building the water works for Ellsworth, Kan., using a large duplex pumping engine, two steel boilers, a duplex boiler feeder, etc., and are also supplying two large duplex pumping engines with duplex condensers, two steel boilers, duplex boiler feeder, etc., for the water works at Marysville, Mo.

CLEVELAND, O., Feb. 22.—Decisive action looking to the settlement of the affairs of Brown, Bonnell & Co. was taken by Judge Baxter to-day in ordering the sale of the immense plant at Youngstown. The firm became involved in financial difficulties, and their business was placed in the hands of a receiver three years ago. It has since then figured in the United States Circuit Court. The claims of the creditors aggregate over $1,000,000.

THE Metropolitan Electric Light Company, of Chicago, has been incorporated. Capital stock, $65,000. Incorporators, Joseph Powell, Henry S. Stoddard and John S. McClure.

THE Lawrence Machine Co., of Lawrence, Mass., has just finished a 24-inch independent contrifugal pump, which is coupled to an 80-horse-power Westinghouse engine. It is for plantation drainage in Louisiana.